From: Leon Garden [mailto:usgardens@sbcglobal.net]
Sent: Friday, March 25, 2005 12:44 PM
To: MLPAComments@resources.ca.gov
Subject: MLPAComments: Comments on Draft MLPA initiative

Please consider my recommendations to clarify the draft document.

Leon Garden.

CALIFORNIA MARINE LIFE PROTECTION ACT INITIATIVE

REVISED DRAFT MASTER PLAN FRAMEWORK

March 15, 2005

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Proposed changes by Leon Garden, Kelp Klimbers SCUBA dive club and Monterey Bay Sea Otters Dive Club

Changes proposed include: clarity of language between consumptive and extractive – consumptive seems to imply taking for eating; documentation of activities which are non-extractive such as: boating, surfing, diving, kayaking, education, scientific research, etc; and a couple of obvious typographical errors. Personal Communications are not suitable references for quotations in the document – they can not be validated. Strikeouts and underlines are in red in my proposals for consideration. My comments are in red and not underlined or strikeover – they may help justify the recommended change.

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Executive Summary

[To be prepared upon the completion of a draft master plan framework.]

Section 1. Introduction

The rich natural heritage of California has supported commercial and recreational fisheries, which have provided consumers with a healthy source of high-quality protein, recreational anglers with a unique experience, and many coastal communities with sources of employment and revenues. California's nearshore waters have become among the top destinations for ~~sport~~ recreational SCUBA divers from around the world. Whether watching the flight of birds or the graceful forms of dolphins and whales, Californians also have increasingly sought enjoyment from observing marine wildlife. The dramatic growth of marine aquaria along the coast also serves as evidence of growing public interest in ocean wildlife, while California's century-long renown as a leader in marine science has only grown. California enjoys beautiful and productive marine resources.

In 1999, the State of California adopted the Marine Life Protection Act (MLPA), one in a long history of statutes and regulations designed to protect California's ocean and estuarine waters and the species and habitats found within them (FGC Section 2851-2863). The Department of Fish and Game is required to prepare and present to the Fish & Game Commission a Master Plan that will guide the adoption and implementation of the Marine Life Protection Program (FGC Section 2855[b]1). The Commission is required to adopt a master plan, based on the best readily available science, which includes recommendations for a statewide network of marine protected areas (FGC Section 2855[a]).

Another relevant law, the Marine Managed Areas Improvement Act (Public Resources Code, Sections 36600 et seq.), was adopted in 1998. The two measures, taken together, represent a very strong state policy declaration that California intends to protect its oceans and the marine species that live there and provide direction on how to proceed with their conservation.

The California Ocean Protection Act, (Public Resources Code, Sections 35500 et seq.) was adopted in 2004. One purpose of this law was to coordinate activities of state agencies that are ~~related to~~ charged with the protection and conservation of coastal waters and ocean ecosystems, in order to improve the effectiveness of state efforts to protect ocean resources within existing fiscal limitations. Related to this legislation, on October 18, 2004, Governor Arnold Schwarzenegger announced an Ocean Action Plan, with four primary goals:

- Increase the abundance and diversity of California's oceans, bays, estuaries and coastal wetlands.
- Make water in these bodies cleaner.
- Provide a marine and estuarine environment that Californians can productively and safely enjoy.
- Support ocean dependent economic activities.

A major part of this Ocean Action Plan is the work of the MLPA Blue Ribbon Task Force and full implementation of the MLPA. These plans and laws are but the latest in California's growing efforts to ensure protection and long-term conservation, use, and enjoyment of its living marine resources.

Among other policies, the Ocean Action Plan also addresses the relationship between California's management activities and the Department of Defense as follows:

- Coordinate California ocean and coastal management activities that impact military facilities/operations with the Department of Defense, as well as requesting the Department of Defense to coordinate their activities and operational needs with the State of California to the extent possible without compromising national security objectives.

Early Years

From its very first days as a state in 1850, California has adopted statutes and regulations dealing with the ocean, fisheries, and protection of resources, commerce and industry. In an historic sense, California's history of involvement (as with most other states) has been through early steps to regulate fishing and define health and safety requirements for those who earn a living on the waters, to protection and preservation of unique areas and features along the California coastline and in state waters. The third bill adopted in the First Session of the California Legislature recognized and regulated the Bay Pilots, the professionals who to this day, guide commercial ships into San Francisco Bay.

In the early decades of statehood, California's policy toward natural resources reflected the desire of government at all levels to promote economic expansion by bringing natural resources into production (McEvoy 1986). Even so, lawmakers in California, as elsewhere, began becoming concerned that the expansion of fishing might well threaten the long-term economic health of the fishing industry. In 1852, the Legislature passed its first fishing statute to regulate the Sacramento River salmon fishery, and continued to do so over the next several decades. In 1870, the Legislature responded to the concerns of sport fishermen by establishing a State Board of Fish Commissioners, which later became today's Fish and Game Commission. In this and other ways, California led the nation. By the end of the 19th century, the California Legislature had adopted a body of fisheries management law that was a model for its time.

At the same time, the courts repeatedly upheld the importance of the state's role in protecting its resources. In 1894, for instance, the California State Supreme Court found that: "The wild game within a state belongs to the people in their collective, sovereign capacity; it is not the subject of private ownership, except in so far as the people may elect to make it so; and they may, if they see fit, absolutely prohibit the taking of it, or any traffic or commerce in it, if deemed necessary for its protection or preservation, or the public good."

Californians often feel strongly about both available fisheries and regulations on access. Some assert that Article 1, Section 25, of the California Constitution seems to give the public a "right to fish." It states "The people shall have the right to fish upon and from the public lands of the State and in the waters thereof…provided, that the legislature may by statute, provide for the season when and the conditions under which the different species of fish may be taken." However, this "right to fish" is not absolute. In 1918, the California Supreme Court considered whether a law providing for the licensing of fishermen was unconstitutional because it violated Article 1, Section 25. The court rejected the argument, finding that the provision authorizing the

Legislature to fix the seasons and conditions under which fish are taken was intended to leave the matter in the Legislature's discretion. As recently as 1995, a court reaffirmed the qualified, not fundamental, right to fish and that the language of the State Constitution was not intended to curtail the ability of the Legislature (or the Fish and Game Commission through legislated authority) to regulate fishing.

Like other economic activities, from agriculture to manufacturing, fishing began expanding rapidly in the first few decades of the 1900s. In 1912, the Legislature respond by authorizing staff for the California Fish and Game Commission, which found itself with greater and greater responsibilities for managing industrial fisheries, in particular. In 1927, the Legislature responded to growing fishing pressures by creating a Department of Natural Resources, within which it housed a Division of Fish and Game. Over the coming decades, California state agencies and universities became leaders in the relatively new field of marine fisheries research and management. In 1945, the Legislature granted the Fish and Game Commission discretionary authority over recreational fisheries. In 1947, the Legislature instituted a tax on sardine landings that was used to fund research into causes for the decline. These activities led to the inauguration of one of the world's longest series of fisheries research cruises: the California Cooperative Oceanic Fisheries Investigations, CalCOFI, a cooperative venture of the California Department of Fish and Game, Scripps Institution of Oceanography, and the National Marine Fisheries Service.

Post World War II

After World War II, the marine policies of California and other state and federal governments were based largely on several assumptions that reflected the progressive thinking of the time. First, the abundance of marine wildlife was thought to be nearly without practical limits. Second, scientists and fishery managers believed that we possessed enough knowledge to exploit marine populations at very high levels over long periods of time without jeopardizing them. Third, the value of marine wildlife was principally as a commodity to be processed and traded. Finally, the chief challenge in commercial fisheries management was to expand domestic fishing fleets in order to exploit the assumed riches of the sea.

In the face of disturbing declines in a number of fisheries, state and federal fisheries agencies around the country began an intensive review of prevailing policies in the mid-1960s. In 1967, the California Legislature passed the California Marine Resources Conservation and Development Act to develop a long-range plan for conservation and development of marine and coastal resources (1967 California Statutes Ch. 1,642). In the same year, Governor Ronald Reagan imposed an emergency two-year moratorium on commercial sardine fishing (1967 California Statues Ch. 278).

Beginning in the 1970s, views slowly shifted. Marine wildlife and ecosystems were increasingly valued for themselves and for non-extractive uses such as tourism, education, and scientific research. Recognition has been growing of the need to balance the fishing capacity of fleets with the often limited and uncertain productive capacity of marine wildlife populations. Rather than seeking to extract only the maximum yield from marine wildlife populations, fisheries managers began seeking levels that are likely to be ecologically and economically sustainable into the distant future.

California's Marine Heritage

For 1,100 miles, the spectacular mass of California's lands meets the Pacific Ocean. In many areas, mountains plunge into the oceans. Elsewhere, ancient shorelines stand as terraces above the surf. Streams and rivers break through the coastal mountains and, in some places, flow into bays and lagoons rimmed with wetlands. Offshore, islands and rocks break the surface.

This is what we can easily see. But beneath the surface of the water offshore, California's dramatic geological formations continue. Unlike the Atlantic or Gulf coasts, California's shallow continental shelf is quite narrow, generally no wider than five miles. At its broadest point off San Francisco, the shelf extends 30 miles offshore before plunging from 600 feet to the abyssal region at 6,000 feet. Beyond state waters, peaks called seamounts rise from the depths to the photic zone where sunlight spurs plant growth and attracts life.

Whether near or far from shore, the ocean bottom may be rocky, sandy, or silty. It may be flat or formed of rocky reefs. In many areas along the coast, great canyons cut into the continental shelf quite close to shore. For example, the Monterey submarine canyon, which is larger than the Grand Canyon of the Colorado, begins within miles of the shoreline. There, as in other submarine canyons, marine life normally found far offshore is drawn close to land by the deep waters. Off southern California, the ocean bottom appears like a piece of crumpled paper, with basins, troughs, canyons, peaks, and cliffs alternating in a checkerboard pattern.

Ocean currents introduce other dimensions to California's coastal waters. For much of the year, the California Current brings colder northern waters southward along the shore as far as southern California. There, where the coastline juts eastward, the California Current moves offshore. In the gap between the California Current and the mainland, the Southern California Countercurrent flows into the Santa Barbara Channel. Around Point Conception, these two currents meet, creating a rich transition zone. Closer to shore and deeper, the California Undercurrent also carries warmer water northward.

Seasonal changes in wind direction commonly create seasonal patterns for these currents. In March, for instance, northwesterly winds combine with the rotation of the Earth to drive surface waters offshore, triggering the upwelling of cold, nutrient-rich water from the depths. Fueled by sunlight and the nutrients, single-celled algae bloom and create a rich soup that fuels a blossoming of marine life, attracting larger animals from seabirds and swordfish to humpback and blue whales.

By September, as the northwesterly winds die down, the cold water sinks again and warmer waters return to the coast. This oceanic period lasts into October, when the predominant winds move to the southwesterly direction. These winds drive a surface current, called the Davidson Current, which flows north of Point Conception and inside the California Current, generally lasting through February.

Laid over this general pattern are both short-term and long-term changes. Local winds, topography, tidal motions, and discharge from rivers create their own currents in nearshore waters. Less frequently, a massive change in atmospheric pressure off Australia floods the

eastern Pacific with warm water, which suppresses the normal pattern of upwelling. These short-term climatic changes, called El Niño, reduce the productivity of coastal waters, causing some fisheries and seabird and marine mammal populations to decline and others to increase. For instance, warm waters that flow north in an El Niño carry the larva of sheephead and lobster from the heart of their geographical range in Mexico into the waters off California.

Other oceanographic changes last for a decade or more and these natural fluctuations can have significant impacts on the health and composition of marine life. In these regime shifts, water temperatures rise or fall significantly, causing dramatic changes in the distribution and abundance of marine life. The collapse of the California sardine fishery occurred when heavy commercial fishing continued on sardine populations that were greatly reduced by a cooling of offshore waters in the late 1940s and early 1950s. In response to the decline in sardines, California law severely curtailed the catch. In 1977, waters off California began warming and remained relatively warm. The warmer water temperatures were favorable for sardines, whose abundance greatly increased. But the warmer waters also reduced the productivity of other fish, including many rockfishes, lingcod, sablefish, and those flatfishes that favor cold water for successful reproduction.

Currents and other bodies of water may differ dramatically in temperature and chemistry, as well as speed and direction. These factors all influence the kinds of marine life found in different bodies of water. In general terms, geography, oceanography, and biology combine to divide California marine fisheries and other marine life into two major regions north and south of Point Conception. Within each region, other differences emerge. Conservation and use of California's marine life depends partly upon recognizing these differences.

Marine Life of California

The waters off California are host to hundreds of species of fish. Thousands of species of marine invertebrates inhabit the sea floor from tidepools along the shoreline to muddy plains 8,000 feet deep. Dozens of species of coastal and offshore birds spend some part of the year in California's waters, as do 35 species of marine mammals.

This great variety of marine life reflects the different responses of groups of animals and plants to changing environmental conditions over long periods of time. In successfully meeting their needs for growth, survival, and reproduction, individual species have developed a set of characteristics that biologists call life history traits. These traits include age at maturity, maximum age, maximum size, growth rate, natural mortality, and feeding and reproductive strategies.

Differences among species can be dramatic. For instance, California market squid mature within 12 months and die soon after spawning, whereas widow rockfish do not mature until age five at the earliest and may live as long as 59 years. This has profound consequences for managing fisheries so that they are sustainable.

Reproductive strategies also vary. Queenfish, for instance, may spawn 24 times in a season, releasing their body weight in eggs into the open water, where most will be eaten whether or not they are fertilized. In contrast, species such as olive rockfish spawn just once a year,

releasing up to 500,000 larvae, which have been fertilized and developed internally. Other species, including sharks and surfperches, bear a small number of fully functional and live young each year.

Amid the variety, the life histories of fish tend to fall into several larger categories. For instance, fish species that have low rates of mortality as adults, such as many species of sharks, bluefin tuna, and billfish, also mature late and reproduce in smaller numbers. Organisms that have high rates of mortality as adults, such as anchovies and squid, grow quickly, mature early, and reproduce in large numbers. Some species spend the first several months of their lives floating as planktonic larvae in ocean currents. Climate and oceanographic changes influence the abundance of these species more than does the number of spawning adults.

Species differ also in their movements. For instance, during winter Dover sole move into deep water where they reproduce, then move into shallow water in the summer to feed. Pacific whiting migrate from their summer feeding grounds off Oregon and Washington to their winter spawning grounds off southern California and Baja California. By contrast, kelp bass, which can live to 30 years, venture less than a mile from their home range.

Individual plants and animals are part of larger communities that are linked in many ways. One of the clearest of relationships concerns who eats whom, also known as the food web. Generally, the eating begins with herbivores, who consume plants that have manufactured food through photosynthesis. These herbivores may be as small as the larva of an anchovy or as large as a basking shark. The smaller herbivores pass along much of the food value of the plants when they are eaten by primary carnivores, which in turn may be consumed by higher level carnivores. Humans enter the food web at a variety of levels, removing not only higher level carnivores, but herbivores, and even the lowest level algae.

These relationships among wildlife populations differ considerably among different habitats and communities. A decrease in the abundance of some species, due to fishing, habitat alteration, or climate changes, for instance, can affect species that feed upon them. Considering these interrelationships when managing fisheries requires an ecosystem perspective.

Healthy habitat can also play an important role in the abundance of marine wildlife. Some species of fish and shellfish are so dependent upon particular types of habitat, such as kelp forests or coastal wetlands, that the destruction or natural alteration of these habitats can devastate wild populations. Damming many major coastal rivers in California has driven most runs of Pacific salmon to dangerously low levels. Since the 1850s, 90 percent of the state's coastal wetlands have been destroyed, causing incalculable losses in coastal wildlife. Finally, pollution of coastal waters can expose marine animals to toxic chemicals and can foster changes in plant communities that wildlife depends upon.

Environmental Factors Affecting Marine Wildlife Populations

The abundance and diversity of populations of marine wildlife are influenced by a wide range of natural and human-caused factors, including short-term and long-term shifts in oceanographic conditions and numerous human activities, which may have direct or indirect

effects (Parrish and Tegner 2001; Sheehan and Tasto 2001; NRC 1995). The impact of each factor varies with distance from shore and with individual species.

Some types of natural phenomena, such as El Niño and La Niña fluctuations, may have transitory impacts on marine wildlife and their habitats, while other natural phenomena, such as longer-term shifts in oceanographic conditions, may affect the abundance of some types of marine wildlife over much longer periods (Parrish and Tegner 2001). Increasingly, fisheries managers are attempting to adjust to these natural phenomena.

As in other coastal states, the development and growth of California's population and economy, especially since World War II, has introduced additional stresses to coastal ecosystems, as development has transformed coastal watersheds, wetlands, and estuaries, and greater demands have been made on coastal ecosystems. These stresses include chemical pollution and eutrophication, alteration of physical habitat, and the invasion of exotic species (NRC 1995). Chemical pollution and eutrophication can alter the abundance and biodiversity of wildlife in estuaries and coastal environments, especially bays and estuaries (NRC 1995). The types of pollution range from toxic chemicals to partially treated sewage, and the sources of potential pollution range from point sources, such as sewage treatment plants, to non-point sources, such as runoff from agricultural and urban lands (Sheehan and Tasto 2001). Similarly, estuarine and shoreline habitats have been especially affected by residential, commercial, and industrial development (Sheehan and Tasto 2001).

The degree of impact from these stresses on water quality and habitats varies markedly along the state's coastline. Along the southern coast, storm-water runoff is a particular problem, while some waters of the central coast are most affected by agricultural runoff (Sheehan and Tasto 2001). San Francisco Bay's waters are affected both by industrial discharges and by dairy farm runoff. In some areas, particularly bays and estuaries, waters are so impaired that certain uses are prohibited or restricted.

In the last 35 years, both federal and state governments have carried out regulatory and other programs to reduce these threats to coastal ecosystems. At the federal level, the Clean Water Act launched an enormous effort to reduce the flow of sewage and industrial pollutants into coastal waters (Sheehan and Tasto 2001). Since 1990, the federal government, in cooperation with state governments, has encouraged efforts to reduce the flow of non-point source pollution. The rate of loss of sensitive coastal habitats has slowed, and in some areas, efforts are underway to restore converted wetlands. In the last several years, the state has devoted more resources to addressing coastal water quality and habitat, including major state bonds. Nonetheless, future population and economic growth will continue to place stress on coastal ecosystems.

The Marine Life Management Act

~~Like these other factors, fishing can have impacts on marine fish populations and other wildlife (Agardy pers comm.)~~. As described above, California has long sought to manage fisheries in its waters for long-term sustainability. In 1998 the Legislature responded to the shifts in understanding and public values as well as declines in some fisheries and nearshore ecosystems by adopting the Marine Life Management Act (MLMA).

Before the MLMA, the responsibility for managing most of California's marine resources harvested by commercial fisheries lay with the State Legislature, while the Department of Fish and Game and the Fish and Game Commission managed the recreational fisheries and those commercial fisheries with catch quotas that changed periodically. Management of commercial fisheries under this division of responsibility was complicated, piecemeal, and oftentimes untimely, with necessary regulatory changes only occurring after much political deliberation and approval by both the California State Assembly and California State Senate.

The MLMA transferred permanent management authority to the Fish and Game Commission for the nearshore finfish fishery, the white seabass fishery, emerging fisheries, and other fisheries for which the commission had some management authority prior to January 1, 1999. As importantly, the MLMA broadened the focus of fisheries management to include consideration of the ecosystem—that is, the species that interact with a fishery.

Recent Developments

The Marine Life Protection Act (MLPA) was enacted in 1999. In doing so, the State Legislature recognized the benefits of setting aside some areas under special protection and of ensuring that these marine protected areas (MPAs) were developed in a systematic manner, with clear goals and objectives, and effective management plans and programs for monitoring and evaluating their effectiveness. Rather than focusing on one use or value for marine areas, the MLPA recognized a wide range of values, including the conservation of biological diversity[1]. Although it may appear that the MLPA was contrary to the spirit of the MLMA in that the Legislature once again became more involved in fishery management, two points are worth noting: 1) the goals of the MLPA do not relate primarily to fishery management; 2) the ultimate decision of how to improve the existing array of MPAs resides with the Fish and Game Commission rather than the State Legislature.

The MLPA had two unsuccessful attempts at implementation between its passage in 1999 and the creation of the MLPA Initiative in 2004. Each attempt suffered from a lack of adequate resources to ensure a robust multi-stakeholder involvement and to provide needed information, particularly as related to the potential socioeconomic impacts of new MPAs. The first attempt was particularly problematic when DFG and the MLPA Master Plan Team developed a set of initial proposals for a statewide network of MPAs without stakeholder input, even though the intent was to revise these initial proposals based on public comment. The second attempt was much more inclusive of stakeholder input, but suffered from a lack of staff availability and funding for the large public involvement process. After these unsuccessful attempts, state legislators and agencies realized that this is a much more complex and controversial process, requiring significant resources and time to implement successfully and evaluate subsequently.

[1] Biological diversity or "biodiversity" is defined by Public Resources Code Section 12220(b) as: a component and measure of ecosystem health and function. It is the number and genetic richness of different individuals found within the population of a species, of populations found within a species range, of different species found within a natural community or ecosystem, and of different communities and ecosystems found within a region.

Shortly after, but unrelated to, passage of the MLPA, several major recreational and commercial fishery closures were enacted to protect populations of certain rockfish species and lingcod that were declared overfished by the National Marine Fisheries Service. The closures, which remain in effect today, are generally depth-based and specific to certain types of bottom-fishing gear. The primary closures are the Cowcod Conservation Area (CCA) in southern California, which is almost entirely in federal waters, and the Rockfish Conservation Area (RCA), which is statewide and encompasses portions of state and federal waters. Additional depth-based seasonal fishing restrictions for certain recreational fisheries were also established during 2000 and 2001 outside of the CCA and RCA and remain in effect today. While portions of the RCA are open seasonally to bottom fishing, certain depth zones in certain parts of the state are closed year-round and thus function as de facto MPAs. One important distinction between these closures and MPAs is that the former, while potentially of long-term duration, are not intended as permanent closures.

A significant increase in the total amount of state waters included in MPAs occurred in 2003 when the Fish and Game Commission adopted a system of 12 new MPAs (10 state marine reserves and 2 state marine conservation areas) around the Santa Barbara Channel Islands. This occurred following a stakeholder-based process which lasted approximately 5 years. Monitoring of the new MPAs, and of the effect they are having on local fishing patterns, is now occurring.

California is able to take advantage of several decades of experience and study regarding MPAs elsewhere in the United States and abroad, as well as within its own waters. As is the case in other areas of natural resource management and conservation, including fisheries management, there is much to learn about the effective design of MPAs and their benefits.

Recent work supports the legislative findings of the MLPA. In 2001, for instance, a committee of the National Academy of Sciences released its report *Marine Protected Areas: Tools for Sustaining Ocean Ecosystems*. Like other reports of the National Academy of Sciences, this report can be considered an authoritative general review of the science of marine protected areas. Among other things, this expert panel concluded:

- A growing body of literature documents the effectiveness of marine reserves for conserving habitats, fostering the recovery of overexploited species, and maintaining marine communities.

- Networks of marine reserves, where the goal is to protect all components of the ecosystem through spatially defined closures, should be included as an essential element of ecosystem-based management.

- Choosing a location for a marine reserve or protected area requires an understanding of probable socioeconomic impacts as well as the environmental criteria for siting.

- It is essential to involve all potential stakeholders at the outset to develop plans for MPAs that enlist the support of the community and serve local conservation needs.

- Marine reserves and protected areas must be monitored and evaluated to determine if goals are being met and to provide information for refining the design of current and future MPAs and reserves.

- Sufficient scientific information exists on the habitat requirements and life-history traits of many species to support implementation of marine reserves and protected areas to improve management.

Since the National Academy of Sciences report, a vigorous discussion among scientists and decision makers has explored the benefits and costs of MPAs, particularly marine reserves (Nowlis and Friedlander 2004; Hilborn et al. 2004; SSC 2004; NFCC 2004; FAO 2004). Many of these discussions have focused upon the use of marine reserves as a fisheries management tool, and the effect of marine reserve designation on fishing operations, fisheries management, and fish populations outside reserves. Scientists agree that empirical evidence for increased fish catches outside marine reserves is sparse. Without additional experience, assessing the appropriateness of marine reserves for fisheries enhancement purposes will remain difficult.

Recent literature acknowledges potential value of marine reserves for protection of habitat and biodiversity within reserve boundaries (Hilborn et al. 2004; FAO 2004). For the purposes of fisheries management, this same literature cites benefits of marine reserves, including buffering against uncertainty, reducing collateral ecological impacts, managing multispecies fisheries, and improving knowledge. At the same time, potential problems with marine reserves have been cited, including possible shifts in fishing effort, disruption of stock assessment research, and socioeconomic impacts (Hilborn et al.2004; FAO 2004; SSC 2004). These authors urge care in the design of marine reserves so as to minimize losses to fisheries and to increase the opportunity to obtain empirical information on marine reserves by careful experimental design (Hilborn et al. 2004; SSC 2004). These studies also note that for certain species, especially species with highly mobile adults, marine reserves are unlikely to benefit fisheries (Nowlis and Friedlander 2004; Hilborn et al.; SSC 2004; NFCC 2004). When designing marine reserves or other MPAs with a goal of enhancing fisheries, the target species and potential impacts must be considered.

MLPA Initiative Process

A more inclusive, robust process for the MLPA Initiative has been developed, with the inclusion of an MLPA Blue Ribbon Task Force (an oversight body), MLPA Initiative staff, a Master Plan Science Advisory Team (an expansion of the former Master Plan Team with additional expertise), a Statewide Interests Group for providing advice on the process, a regional stakeholder group for each region of the phased process of developing alternative proposals for proposed MPAs, a peer review group, DFG staff, and the Fish and Game Commission. A flow chart is provided to explain the links within the process (see Figure 1).

Role of the Master Plan Science Advisory Team

The Master Plan Science Advisory Team (SAT) is charged with assisting the task force in developing a draft Maser Plan Framework by reviewing and commenting on scientific papers,

reviewing draft Master Plan documents, and addressing scientific issues presented by those documents. The SAT may provide information concerning habitat mapping, which habitats to include in an MPA network, habitat requirements of species, regional species lists, and potential socioeconomic impacts of proposed MPAs, and may assist in the evaluation of the effectiveness of existing MPAs. The SAT will review alternative MPA proposals developed by the Regional stakeholder groups and provide comment relative to the science-based requirements of the MLPA.

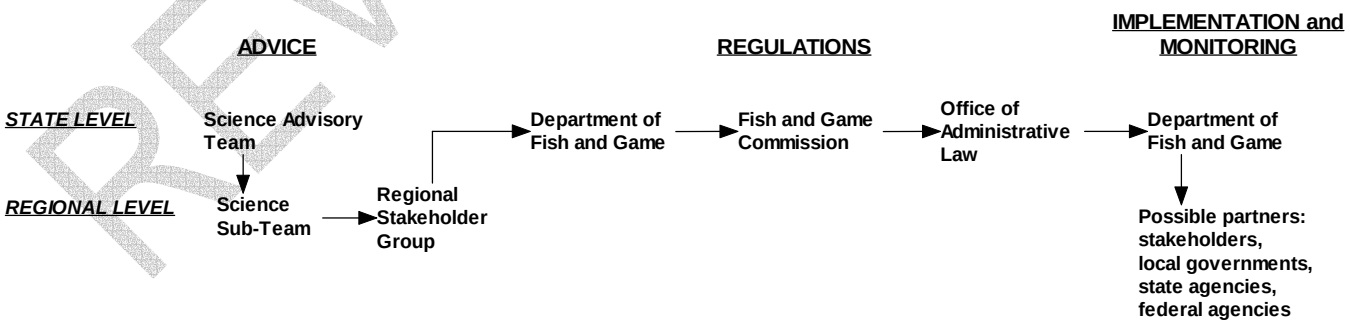
Role of the Regional Stakeholder Groups

Each regional stakeholder group (RSG) will be responsible for initially evaluating the existing MPAs within its region. This group will serve as a focus for regional discussions regarding the major aspects of designing MPA alternatives, including: 1) setting goals and objectives; 2) discussing the needs for additional MPAs within the region in order to meet the requirements of the MLPA; 3) evaluating existing relevant biological and socioeconomic information; 4) determining needs for additional information; and 5) developing options on the type, location, size, and boundaries for individual components of the network. The RSG should have the best available scientific information and mapping data for the region, and this information should be available to the public. A member of the SAT subteam will attend each RSG meeting to provide assistance. The RSG will work closely with a sub-team, and both of these groups will be provided organizational, process, and scientific support by DFG and MLPA Initiative staff.

The director of the Department of Fish and Game and the central coast project manager for the MLPA Initiative will solicit nominations, and select from the nominees a group representing the range of stakeholder interests in the study region.

The final arrow in the Regional Levels from Dept of Fish and Game to Possible partners seems better placed under Fish and Game Commission below the area of regulations. But then implementation and onitoring are separate major activities and probably should not be combuned in a chare like this that attempts to simplify the process.

Figure 1: Actors in the Marine Life Protection Act



Note: input is solicited from the interested public and stakeholders at each step, until adoption of regulations by the Fish and Game Commission.

Master Plan Framework

The MLPA calls for the development of a master plan by the Department of Fish and Game, and its adoption by the Fish and Game Commission. The MLPA Initiative has divided the master plan into two principal parts: a section providing guidance in the application of the MLPA to the development of a statewide MPA network, and a section describing the preferred alternatives for MPA proposals. One of the objectives of the MLPA Initiative is to develop a master plan framework that can guide the design of MPA proposals in the central coast study region. By March 2006, the task force will have provided both the master plan framework and a recommended range of alternative MPAs in the central coast study region to the Department of Fish and Game for its consideration and submission to the California Fish and Game Commission. The MLPA Initiative intends that the master plan framework serve as a basis for future efforts by the Department of Fish and Game and the Fish and Game Commission in implementing the MLPA and in assembling a statewide network by 2011. However, the aim of this master plan framework is to guide the work of the task force over the next year.

This draft master plan framework is meant to establish and guide a process for implementing the MLPA through the design and adoption of MPAs in each region along the California coast. In the coming years, application of the master plan's guidance in individual regions will no doubt lead to changes in the guidance itself. In this sense, this master plan framework should be viewed as a living document that should change adaptively to experience. When a complete MPA network has been adopted by the Fish and Game Commission for all regions in 2011, the requirements of the MLPA for the adoption of a master plan will be met.

It is important to emphasize that this master plan framework is meant to guide decision making about MPAs in individual regions. Specific application of the framework will depend upon the physical, biological, social and economic conditions in the study region. For example, California coastal waters, especially those in southern California, are critical for our nation's military both for training and testing as well as operations. The military controls two of the Channel Islands and has installations along significant portions of the coastline. Many of the operational ocean areas are significantly restricted to public access. Based on inputs from the military services, the designation of MPAs in designated operational areas of the military is not consistent with military readiness. Therefore, in assessing the overall MLPA network, the beneficial effects of military operational areas with respect to habitat conservation goals will be considered in the needs assessment.

The central coast effort will provide concrete experience with applying the master plan framework and this more specific guidance to a specific area. This experience, in turn, may lead to recommendations to adjust the framework and the guidance on specific topics. In this way, the master plan framework will serve as the foundation for an evolution of practice that adapts to new information.

Section 2. Design of MPAs and the MPA Network

In order to achieve the statutory mandate of a Marine Life Protection Program, which includes a statewide network of MPAs, this master plan framework recommends a process for identifying, reviewing and selecting MPA networks along the California coastline.

This section describes the MLPA Blue Ribbon Task Force (BRTF) process for designing MPAs in individual regions, considerations in the design of MPAs, and the roles of interested parties in this process. Upon completion of the central coast project, the BRTF will provide recommendations to the Department of Fish and Game and to the Fish and Game Commission regarding a process for designing MPAs in other regions of the state.

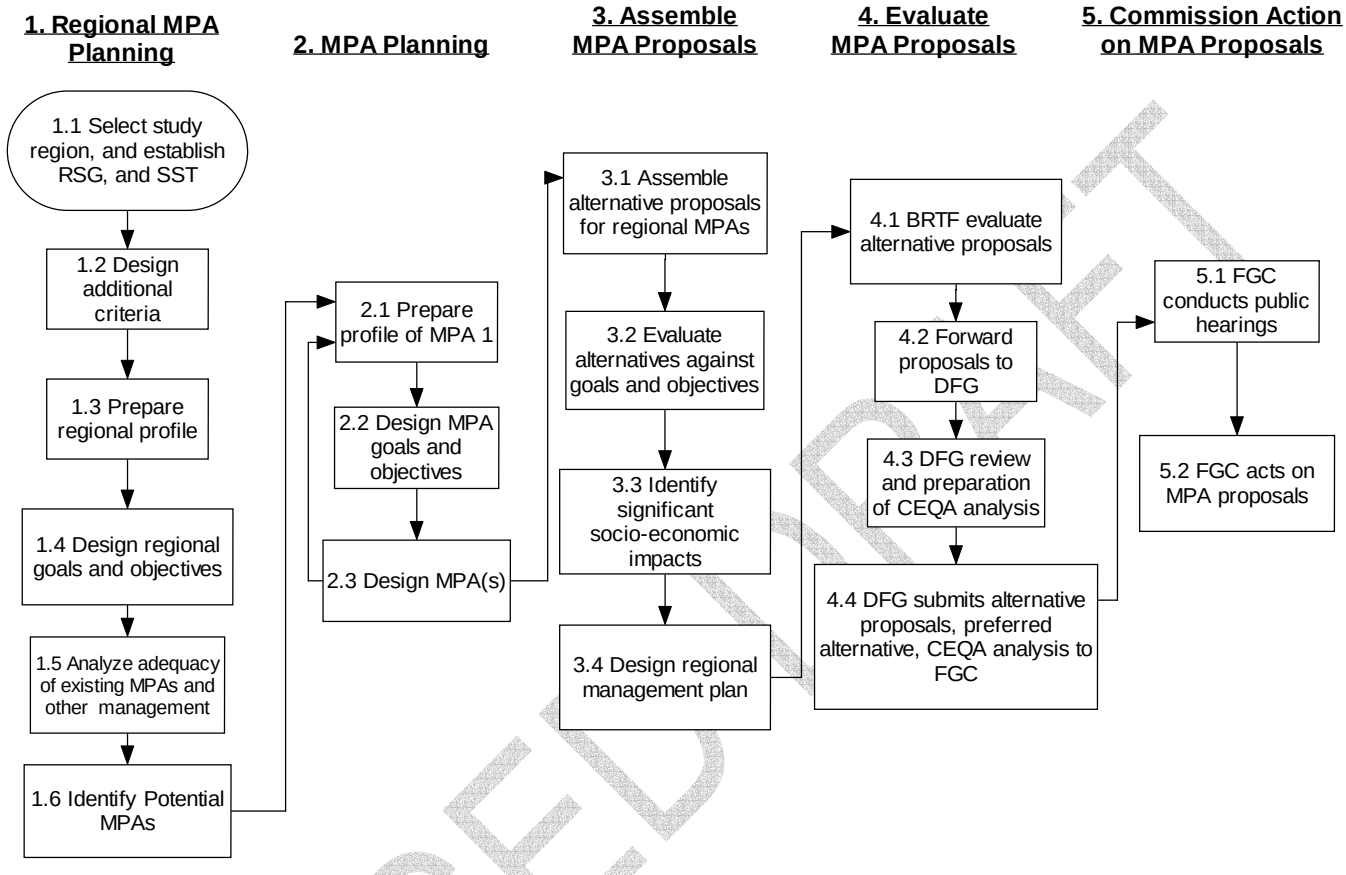
The BRTF MPA Design Process

The MPA design process is composed of five general activities:

1. Regional MPA planning, which starts with the identification of a region along the coast that constitutes a logical scientific and governmental locale for studying where MPAs might appropriately be placed;
2. MPA planning, which involves extensive consultation with interested parties, and development of both science teams and regional stakeholder groups;
3. Identification of alternative MPA proposals;
4. Evaluation of the alternative MPA proposals, and identification of the recommended MPA network within each region; and
5. Fish and Game Commission action on MPA proposals.

Figure 2 (next page) illustrates these five general activities and the major elements of each. Table 1 provides a summary of the activities and elements of the activities, together with a list of the lead actors and the groups to be consulted.

Figure 2: Process for MPA Planning in Study Regions



Throughout this process, regional discussions will be regularly reported to the BRTF, and as appropriate, to the Fish and Game Commission. In addition, staff will provide informational, logistical, and other support to regional activities.

The appendix does not describe the selection process for regional stake holders – the process has lots of actions on "suggest/comment" assigned to the unspecified regional stakeholders (RSG). This step in the process of developing the draft master plan framework should be returned to the public for comment before being adopted.

Table 1: Process for MPA Planning in Study Regions			
	Key to acronyms: BRTF = Blue Ribbon Task Force; CEQA = California Environmental Quality Act; DFG = Department of Fish and Game; FGC = Fish and Game Commission; MLPAI = MLPA Initiative including DFG; RSG = Regional Stakeholder Group; SAT = Science Advisory Team; SST = Science Sub-Team		
	TASK	***LEAD ACTORS***	***SUGGEST/COMMENT***

REGIONAL PLANNING			
1.1	***Establish regional process***		
1.1.1	Select a study region	BRTF	
1.1.2	Convene regional stakeholder group (RSG)	DFG	Stakeholders
1.1.3	Select science sub-team (SST)	SAT	
1.1.4	Develop workplan and budget for regional effort	BRTF/DFG	
1.2	***Develop additional criteria***		
1.2.1	Identify issues requiring additional criteria for designing MPAs in the study region	RSG/SST/MLPAI	Stakeholders/SAT
1.2.2	design additional criteria for designing MPAs in the study region	MLPAI/SST	RSG/Stakeholders
1.2.3	Review additional criteria for designing MPAs in the study region	BRTF/FGC/SAT	RSG/Stakeholders
1.2.4	Adopt additional criteria for designing MPAs in the study region	BRTF	
1.3	***Prepare regional profile***		
1.3.1	Assemble regional information on biological, oceanographic, socio-economic, and governance aspects of the region	MLPAI	Stakeholders
1.3.2	Review general regional information on biological, oceanographic, socio-economic, and governance features of the region	RSG/SST	Stakeholders
1.3.3	Evaluate general distribution of representative and unique habitats	RSG/SST	Stakeholders
1.3.4	Evaluate wildlife populations, habitats, and uses of concerns	RSG/SST	Stakeholders
1.3.5	Evaluate activities in general affecting populations, habitats, and current uses of concern	RSG/SST	Stakeholders
1.3.6	Identify species generally likely to benefit from MPAs, and their regional distribution	RSG/SST	Stakeholders
1.3.7	Identify extent of habitat to be included in MPAs, in general	RSG/SST	Stakeholders
1.3.8	Identify activities other than fishing that affect coastal ecosystems in the region, and management of those activities	RSG/SST	Stakeholders
1.3.9	Develop, review, and adopt regional profile based on the above	RSG/SST/SAT/ BRTF	Stakeholders
1.4	***Design regional goals and objectives***		
1.4.1	Design regional goals and objectives	RSG/SST	Stakeholders
1.4.2	Review regional goals and objectives	BRTF/FGC/SAT	Stakeholders
1.4.3	Approve regional goals and objectives	BRTF	
1.5	***Analyze adequacy of regional management***		
1.5.1	Evaluate existing MPAs against goals and objectives	RSG/SST	Stakeholders
1.5.2	Recommend whether to retain as is, modify, reduce, expand, or abolish existing MPAs	RSG/SST	Stakeholders

1.5.3	Evaluate existing management activities against the MLPA and regional goals and objectives	RSG/SST	Stakeholders
1.5.4	Identify inadequacies in existing MPAs and management	RSG/SST	Stakeholders
1.6	***Identify potential MPAs***	RSG/SST	Stakeholders
PROPOSED MPA PLANNING			
2.1	***Prepare profile of potential MPA***		
2.1.1	Assemble and review information on biological, oceanographic, socio-economic, and governance aspects of MPA	MLPAI/RSG/SST	Stakeholders
2.1.2	Evaluate distribution of representative and unique habitats	RSG/SST	Stakeholders
2.1.3	Evaluate wildlife populations, habitats, and uses of concerns	RSG/SST	Stakeholders
2.1.4	Evaluate activities affecting populations, habitats, and current uses of concern	RSG/SST	Stakeholders
2.1.5	Identify species likely to benefit from MPAs	RSG/SST	Stakeholders
2.1.6	Identify extent of habitat to be included in MPAs	RSG/SST	Stakeholders
2.1.7	Design, review, and adopt MPA profiles	RSG/SST	Stakeholders
2.2	***Design MPA goals and objectives***		
2.2.1	Identify goals and objectives for the MPA	RSG/SST	Stakeholders
2.2.2	Review and request revision of goals and objectives at the MPA	SAT/BRTF	Stakeholders
2.2.3	Approve goals and objectives for the planning site and forward to FGC for review	BRTF	
2.3	***Design MPAs***		
2.3.1	Evaluate existing MPAs against the goals and objectives	RSG/SST	Stakeholders
2.3.2	Evaluate different types of MPAs for meeting goals and objectives of the MPA and of the MLPA	RSG/SST	Stakeholders
2.3.3	Design boundaries, management and enforcement measures for MPAs, as well as monitoring and budgets	RSG/SST	Stakeholders
2.3.4	Identify likely socio-economic impacts of the MPAs	RSG/SST	Stakeholders
2.3.5	Identify recommended measures by other authorities regarding activities other than fishing that adversely affect the resources of the proposed MPA	RSG/SST	Stakeholders
ASSEMBLING ALTERNATIVE REGIONAL MPAS			
3.1	**Assemble MPA proposals into alternative proposals for the regional MPA component of statewide network**	RSG/SST	Stakeholders
3.2	**Evaluate these MPA alternatives against regional goals and objectives and the MLPA**	RSG/SST	Stakeholders
3.3	**Identify significant socio-economic impact**	RSG/SST	Stakeholders

3.4	**Design general management plan for MPAs in the region, including monitoring, enforcement, and financing, periodic review of effectiveness**	RSG/SST	Stakeholders
EVALUATE MPA PROPOSALS			
4.1	**Evaluate alternative proposals for regional MPA component against the MLPA**	BRTF	Stakeholders
4.2	**Forward alternative proposals to DFG for consideration and submission to FGC**	BRTF	
4.3	**DFG review of alternative proposals and preparation of CEQA analysis**	DFG	
4.4	**DFG submission of alternative proposals, preferred alternative and CEQA analysis to FGC**	DFG	
COMMISSION CONSIDERATION AND ACTION			
5.1	**FGC review of alternative proposals and public testimony**	FGC	Stakeholders/DFG/ BRTF
5.2	**FGC acts on MPA proposals**	FGC	

The text below describes in greater detail the process for MPA planning in study regions.

Task 1: Regional MPA Planning

Implementing the statutory goals of the MLPA starts with adoption of the master plan framework. The other main goal of the MLPA is to identify possible MPA sites along the California coast. The task force recommends that DFG and the Fish and Game Commission divide the coast into multiple study regions. At an appropriate time in the future, and after learning the lessons of the Central Coast MLPA Project, the task force will recommend possible regions for future analysis and MPA evaluation. The general steps in this activity, for the task force, are the following (See Figure 2 and Table 1):

During the MLPA Initiative process, designing MPAs begins with identification of a study region by the MLPA Blue Ribbon Task Force (BRTF). The study region will focus initial efforts to implement this framework in a discrete area. For the MLPA Initiative, the BRTF will oversee all aspects of regional planning in the initial study region.

Activity 1.1: The purpose of this designation is to allow a detailed evaluation of the region and identification of possible MPA sites within that region.

> Activity 1.1.1: Based upon advice from the science advisory team, DFG, and stakeholders, a geographical region within which to evaluate and design MPAs is selected.

Activity 1.1.2: Once the study region is identified, the director of the Department of Fish and Game (DFG) convenes a group of stakeholders in the region to participate, as a regional stakeholder group, in the evaluation of existing MPAs and the design of any additional MPAs.

Activity 1.1.3: The science advisory team identifies members who will serve on a science sub-team, which will work closely with the regional stakeholder group, and will serve as a link to the science advisory team.

Activity 1.1.4: In collaboration with the regional stakeholder group and the science sub-team, staff develop a work plan and budget for designing alternative MPA proposals in the study region.

Activity 1.2: Identify issues and design additional criteria.

Activity 1.2.1: The regional stakeholder group, the science sub-team, and staff identify issues requiring additional criteria for designing MPAs in the study region.

Activity 1.2.2: In consultation with the MLPA Science Advisory Team (SAT) staff design draft criteria on these issues.

Activity 1.3: Prepare regional profile.

Activity 1.3.1: Staff assemble regional information on biological, oceanographic, socio-economic, and governance aspects of the region, and draws upon suggestions and information provided by local communities and other stakeholders in the study region.

Activity 1.3.2: The regional stakeholder group and the science sub-team, review regional information and consider comments from stakeholders. The regional groups may request obtaining additional information.

Activity 1.3.3: The regional stakeholder group and the science sub-team evaluate the distribution of representative and unique habitats in the study region and identify any significant gaps in information.

Activity 1.3.4: The regional stakeholder group and the science sub-team identify and evaluate wildlife populations, habitats, and uses of areas in the study region that may be of concern for conservation or other reasons identified in the MLPA.

Activity 1.3.5: As described earlier, marine wildlife and habitats may be affected by a wide range of human activities. The regional stakeholder group and the science sub-team identify such activities affecting marine wildlife and habitats in the study region.

Activity 1.3.6: Drawing the upon species list described elsewhere in the master plan framework, the regional stakeholder group and science sub-team develop a list of species likely to benefit from MPAs and document their regional distribution.

Activity 1.3.7: Drawing upon the list of habitats that are to be represented in marine reserves in a region, the regional stakeholder group and science sub-team recommend the extent of habitat to be included in MPAs within the study region.

Activity 1.3.8: The regional stakeholder group and science sub-team identify extractive activities other than fishing that may affect coastal ecosystems, and describe management of those activities.

Activity 1.3.9: The regional stakeholder group reviews and adopts a regional profile based upon the above activities and submits that profile for review by the science advisory team.

Activity 1.4: Design regional goals and objectives

Activity 1.4.1: Drawing upon the regional profile and the standards of the MLPA, the regional stakeholder group and the science sub-team design recommended regional goals and objectives. (See discussion of setting goals and objectives below.)

Activity 1.4.2: The regional goals and objectives designed in the regional effort are reviewed by the science advisory team, whose comments are forwarded to the task force. The task force reviews the proposed regional goals and objectives and provides comments and suggestions to the regional effort for consideration in revision. The task force also forwards its comments and suggestions, together with the proposed regional goals and objectives, to the Fish and Game Commission.

Activity 1.4.3: The task force approves the regional goals and objectives, when satisfied that they meet the standards of the MLPA.

Activity 1.5: Analyze adequacy of existing MPAs and management activities

Activity 1.5.1: The regional stakeholder group and the science sub-team evaluate existing MPAs in the study region against the regional goal and objectives and the MLPA.

Activity 1.5.2: The regional stakeholder group and the science sub-team recommend whether to retain as is, modify, reduce, expand, or abolish existing MPAs, and provide a rationale for doing so.

Activity 1.5.3: The regional stakeholder group and the science sub-team evaluate existing management of other human activities against regional goals and objectives and the MLPA. Where this other management may meet regional goals and objectives and the MLPA in all or part of the region, this should be noted.

Activity 1.5.4: The regional stakeholder group and the science sub-team identify inadequacies in existing MPAs and management activities in meeting the goals and objectives of the study region and of the MLPA.

Activity 1.6: Identify potential MPAs

Task 2: MPA Planning

Activity 2.1: Prepare profile of each MPA. Note that the following seven steps are carried out for each of the MPAs identified in the previous activity.

Activity 2.1.1: Staff assemble information on biological, oceanographic, socio-economic, and governance aspects of the MPA. The regional stakeholder group and the science sub-team review this information and may request additional information.

Activity 2.1.2: The regional stakeholder group and the science sub-team evaluate the distribution of representative and unique habitats in the MPA, based on the information assembled in Activity 2.1.1, and information provided by stakeholders, including local communities and fishermen.

Activity 2.1.3: The regional stakeholder group and the science sub-team identify and evaluate wildlife populations, habitats, and uses of concern in the study site.

Activity 2.1.4: The regional stakeholder group and the science sub-team identify and evaluate activities that may affect populations, habitats, and current uses of concern.

Activity 2.1.5: The regional stakeholder group and the science sub-team identify species likely to benefit from MPAs in the MPA.

Activity 2.1.6: The regional stakeholder group and the science sub-team identify the extent of habitat to be included in MPAs at the MPA.

Activity 2.1.7: In consultation with the regional stakeholder group and the science sub-team, staff prepare a profile of the MPA based on the information developed in activities 2.1.1 to 2.1.6. The regional stakeholder group and the science sub-team review and adopt the profile as the basis for the next major activity.

Activity 2.2: Design MPA goals and objectives

Activity 2.2.1: Based on the site planning profile, the regional goals and objectives, and the MLPA, the regional stakeholder group and the science sub-team designs recommended goals and objectives for MPA(s) at the MPA.

Activity 2.2.2: The regional goals and objectives for the MPA are reviewed by the science advisory team.

Activity 2.2.3: The DFG approves the goals and objectives for the MPA.

Activity 2.3: Designing MPA(s)

Activity 2.3.1: The regional stakeholder group and science sub-team evaluate any existing MPAs against the MLPA's goals and objectives.

Activity 2.3.2: The regional stakeholder group and science sub-team evaluate different types of MPAs and combinations of MPAs for meeting the goals and objectives of the MLPA, regional goals and objectives, and the network.

Activity 2.3.3: The regional stakeholder group and science sub-team design boundaries, management and enforcement measures for MPAs, as well as a monitoring plan and budgets.

Activity 2.3.4: The regional stakeholder group and science sub-team identify likely socio-economic impacts of the MPA(s) that should be considered in subsequent analyses.

Activity 2.3.5: The regional stakeholder group and science sub-team recommend measures that may be taken by other authorities to mitigate the effects of activities other than fishing that adversely affect the resources of the proposed MPA.

Task 3: Assembling Alternative Regional MPAs

Activity 3.1: The regional stakeholder group and science sub-team assembles MPA proposals at individual MPAs into alternative proposals for MPAs in the study region.

Activity 3.2: The regional stakeholder group and the science sub-team evaluate these alternative proposals against regional goals and objectives and the MLPA.

Activity 3.3: The regional stakeholder group and the science sub-team identify potentially significant socio-economic impacts from the alternative proposals.

Activity 3.4: The regional stakeholder group and the science sub-team designs a general management plan for MPAs in the region, including monitoring, enforcement, financing, and periodic review of effectiveness.

Task 4: Evaluate MPA Proposals

Activity 4.1: The regional stakeholder group and the science sub-team forwards the alternative MPA proposals, initial evaluations, and general management plan to the task force, which evaluates these proposals against the MLPA's standards.

Activity 4.2: The task force forwards alternative proposals for MPAs, initial evaluations, and the general management plan, together with its own evaluation, to DFG for its consideration and submission to the Fish and Game Commission.

Activity 4.3: DFG reviews the alternative proposals, initial evaluations, and general management plans, and amends these documents consistent with its authorities. DFG

prepares any analyses required by the California Environmental Quality Act (CEQA) or other relevant law.

Activity 4.4: DFG submits the alternative proposals, a preferred alternative, the submissions of the regional groups and the task force, as well as any CEQA or other analysis, to the Fish and Game Commission.

Task 5: Commission Consideration and Action

Activity 5.1: The Fish and Game Commission reviews the alternative regional proposals and takes public testimony.

Activity 5.2: The Fish and Game Commission acts on alternative regional proposals.

Considerations in the Design of MPAs

Designing MPAs in each region will require the consideration of a number of issues, some of which are addressed in the MLPA itself. These are as follows:

- Goals of the Marine Life Protection Program
- MPA networks
- Types of MPAs
- Settling goals and objectives for MPAs
- Geographical regions
- Representative and unique habitats
- Species likely to benefit from MPAs
- Enforcement considerations in setting boundaries
- Socioeconomic impacts of MPAs
- Information used in the design of MPAs
- Other activities affecting resources of concern

Each of these issues is discussed below.

Goals of the Marine Life Protection Program

The foundation for achieving the goals and objectives of the MLPA is a Marine Life Protection Program (MLPP), which must be adopted by the California Fish and Game Commission. The MLPA sets the following goals for the MLPP [FGC subsection 2853(b)]:

(1) To protect the natural diversity and abundance of marine life, and the structure, function, and integrity of marine ecosystems.
(2) To help sustain, conserve, and protect marine life populations, including those of economic value, and rebuild those that are depleted.
(3) To improve recreational, educational, and study opportunities provided by non-extractive activities in marine ecosystems ~~that are subject to minimal human~~

~~disturbance,~~ and to manage these uses in a manner consistent with protecting biodiversity.

(4) To protect marine natural heritage, including protection of representative and unique marine life habitats in California waters for their intrinsic value.

(5) To ensure that California's MPAs have clearly defined objectives, effective management measures, and adequate enforcement, and are based on sound scientific guidelines.

(6) To ensure that the state's MPAs are designed and managed, to the extent possible, as a network.

Meeting the goals of the MLPA requires that an MPA network reflect these goals in their own goals, objectives, management, monitoring and evaluation.

The goals of the MLPP go beyond the scope of traditional management of activities affecting living marine resources, which have focused upon maximizing yield from individual species or groups of species. This is particularly true of the first goal, which emphasis biological diversity and the health of marine ecosystems, rather than the abundance of individual species. The second goal recognizes a role for MPAs as a tool in fisheries management. The third recognizes the importance of recreation and education in MPAs, while including considerations for the ~~these against the~~ protection of biodiversity. The fourth recognizes the value of protecting representative and unique marine habitats for their own value. The fifth and sixth goals address the deficiencies in California's existing MPAs that the MLPA identifies elsewhere in the law. (See the glossary in Appendix A for definitions of some key terms in this goal statement.)

MPA Networks

One of the goals of the Marine Life Protection Program calls for designing and managing the state's MPAs as a network, to the extent possible. Although neither statute nor legislative history defines "network," the ordinary dictionary usage contemplates *interconnectedness* as a necessary characteristic of the term. The term "reserve network", which can also be applied to the other two types of MPAs, has been defined as a group of reserves which is designed to meet objectives that single reserves cannot achieve on their own (Roberts and Hawkins, 2000). In general this definition may infer some direct or indirect connection of MPAs through the dispersal of adult and/or larval organisms or other biological interactions. In some cases, larval dispersal rates are not known and oceanography or ocean current patterns may be combined with larval biology to help determine connectivity.

Network components will likely differ in each region of the state. The MLPA also requires that the network as a whole meet the various goals and guidelines set forth by the law and contemplates the adaptive management of that network [Fish and Game Code Section 2857(c)(5)]. In order to meet those goals a strict interpretation of an ecological network across the entire state, based on larval dispersion and connectivity, may not be possible.

There are other interpretations of the term "network" as it applies to MPAs. A network could be simply a coordinated system of MPAs from which valuable science can be derived. MPAs within a network might also be ~~k~~linked by administrative function, as opposed to biological function. The important aspects of this interpretation are that MPAs are linked by common

goals and a comprehensive management and monitoring plan, and that they protect areas with a wide variety of representative habitat as required by the MLPA. MPAs should be based on the same guiding principles, design criteria, and processes for implementation. In this case, a statewide network could be one that has connections through design, funding, process, and management. At a minimum, the Master Plan should insure that the statewide network of MPAs reflects a consistent approach to design, funding and management.

Because of the phased approach of the MLPA Initiative, the statewide network of MPAs called for by the MLPA will be developed in phases, region by region. Within each region, components of the statewide network will be designed consistent with the MLPA and with regional goals and objectives. Each component ultimately will be presented as a series of options, developed in a regional process involving a regional stakeholder group and a sub-group of the Master Plan Science Advisory Team, with a preferred alternative identified by DFG.

Science Advisory Team Advice on MPA Network Design
(Note this information will be revised based on Master Plan Science Advisory Team input and public comment)

1. MPAs should be in different marine habitats, bioregions and upwelling centers

The strong association of most marine species with particular habitat types (e.g., sea grass beds, submarine canyons, shallow and deep rock reefs), and variation in species composition across latitudinal, depth clines and bioregions, implies that habitat types must be represented across each of these larger environmental gradients to capture the breadth of biodiversity in California's waters.

MPAs should also be located inside and outside of all major upwelling centers as well as in all bioregions because upwelling greatly influences the distribution of species on the western coast of the United States. There are about five major upwelling centers off California and Oregon and upwelling plumes transport water offshore at almost all headlands, which are spaced approximately every 100 km along the California coast. Although there is some exchange between adjacent plumes, most of the upwelled water exists in quasi-enclosed cells with eddies that transport water back towards shore. Water circulation associated with these upwelling cells is a key feature in the survival and dispersal of many marine larvae.

2. Target species are ecologically diverse

MPAs protect a large number of species within their borders, and these species can have dramatically different requirements. As a result, it is more practical to think about protecting groups of species based on spatial distribution of functional categories (e.g., sessile invertebrates, sedentary fishes, migratory fishes, mammals, birds, etc.). It is also reasonable to heavily consider the ecologically and economically dominant species groups when selecting MPAs. In addition, knowledge of the distribution of rare and endangered species should supplement the use of species groups.

3. Permanent MPAs are especially critical for long lived animals

Two clear objectives for establishing self-sustaining MPAs are to protect areas that are important sources of spawning biomass and to protect areas that will receive recruits and thus be future sources of spawning potential. In the first objective of protecting areas that serve as source populations, protection should occur both for areas that historically contained high fish abundance and for areas that currently contain high fish abundance. Historically productive fishing areas, which are now depleted, are likely to show a larger, positive, but slower response to protective measures. Areas that currently contain high fish abundance may show a more immediate, but smaller magnitude of response to protection by increasing existing spawning biomass. Protecting historically abundant areas alone is insufficient, however, because the relatively long life span and sporadic recruitment of many marine fishes indicate that it will take a long time after harvest ceases for large spawning animals to repopulate those areas. The biological characteristics of longevity and sporadic recruitment also suggest that the concept of a rotation of open and closed areas will probably not work for species in California as it has for faster growing, more sedentary animals in other parts of the world.

4. Size and shape guidelines

The size of an individual MPA should be large enough to encompass the typical movements of protected species. Tag returns indicate that net movements of many of the nearshore species, particularly reef-associated species, are on the order of 1-5 km, although a few of the nearshore species have been shown to move tens to hundreds of kilometers. Tagging studies have also shown that the daily movement of many species is much greater than the net annual movements. Thus, a species that is known to have net annual movements of 5 km (for example) will most likely exhibit daily or weekly movements on the order of 10 km. Some of the relatively sedentary species also undertake greater seasonal movements. Information about these adult neighborhood sizes should be part of MPAs design. Current data suggest that MPAs less than about 10 km in extent will be less effective in protecting adult populations. Larger MPAs, 10-20 km are probably a better choice given current data on adult fish movement patterns. Many pelagic fishes have large neighborhood sizes, and are only likely to benefit from small MPAs if fishing pressure is very high.

Less is known about the net movements of most of the deeper water sedentary fishes, especially those associated with soft-bottom habitat, but it is reasonable to suspect that the range of movements will be similar or greater than those of nearshore species. One cause of migration in demersal fishes is the changing resource/habitat requirements of individuals as they grow. Thus, individual ranges can reflect the gradual movement of an individual among habitats, and MPAs that encompass more diverse habitat types will more likely encompass the movement of an individual over its lifetime. Although fisheries may not target younger fish, offshore reserves that include inshore nursery habitats increase the likelihood of replenishment of adult populations offshore. Such reserves would also protect younger fish from incidental take (i.e. by-catch). Fish with moderate movements, especially those in deeper water, will require larger MPA sizes. Because several species also move between shallow and deeper habitat, MPAs that extend offshore (from the coastline to the 3-mile offshore boundary of State waters) will accommodate such movement and protect individuals over their lifetime.

Typically, the relative amount of higher relief rocky reef habitat decreases with distance from shore. In those areas, a MPA shape that covers an increasing area with distance offshore (i.e. a wedge shape) may be an effective design. This shape also better accommodates the greater movement ranges of deeper water and soft-bottom associated fishes. The size of a protected area should also be large enough to facilitate enforcement and to limit deleterious edge effects caused by fishing adjacent to the MPA. MPA shape should ultimately be determined on a case-by-case basis using a combination of information about bathymetry, habitat complexity, and species distribution and relative abundance.

5. Spacing between MPAs

Movement out of, into and between MPAs by larvae of marine species depends on their distance of dispersal. Important determinants of dispersal distance are the length of the planktonic period, current regimes, larval behavior, and environmental stress. Based on emerging genetic data from species around the world, larval movement of 50 - 100 km appears common in marine invertebrates. For fishes, larval neighborhoods appear generally larger, based on genetic data, ranging up to 100 - 200 km. For MPAs to be within dispersal range for most commercial or recreational species, they will need to be on the order of no more that 50-100 km apart. Current patterns, retention features such as gyres, bays, eddies, and the lees of headlands may create local dispersal conditions that differ from the average. Although dispersal data appear to be valid for a wide range of species, there are only a small number of coastal marine species in California that allow these estimates of larval neighborhoods to be made with confidence.

6. Minimal replication of MPAs

MPAs in a particular habitat type need to be replicated along the coast. Three major reasons are to provide stepping stones for dispersal of marine species, to insure against local environmental disaster (e.g. oil spills) that can destroy an individual, small reserve, and to provide independent experimental replicates for scientific study of MPA effects. Ideally at least five replicates (but a minimum of three) should be placed in the MPA network to serve these goals.

7. Placement along a heterogeneous coast

The fate (i.e. survival) of young produced by a protected population depends on their likelihood of survival in the coastal ocean and conditions at the site that they disperse to. Environmental conditions that determine this are variable and it is therefore difficult to predict from year to year the contribution of spawning sources. Given this uncertainty, a precautionary approach to protect viable source populations would be to distribute a series of MPAs along the coast that are located at various distances from headlands (i.e. distances from centers of upwelling cells). Given the longevity of many marine species, a single MPA may serve either as a source (i.e. positive contribution to the replenishment of regional populations) or a sink (i.e. negative contribution) for a few short time periods (e.g., 1-5 yr) in any longer time period (e.g., 50 yr). Thus, a network of MPAs should contain protected areas that are located and designed with consideration for oceanographic currents to maximize chances of larvae and juveniles moving alongshore, offshore, and inshore. In all cases, the design and setting of MPAs should account

for the habitat type and quality both inside and outside the MPA. It makes little sense to protect an area if the water quality inside and adjacent to the MPA is poor.

8. Human activities ranges and MPA placement

The geographic extent of human activities is suggestive of size and placement of MPAs. Fishing fleets and other user groups typically have a finite home range from ports and access points along the coast. Many activities, especially in central California, are day-based and conducted from motor, sail or hand powered crafts with ranges between 1 and 25 nautical miles. To the extent that MPAs are designed to limit consumptive uses, MPAs located farthest away from access points will tend to be associated with lower costs than, say, a ~~marine reserve~~ MPA located outside a ~~breakwater~~ marina. By the same token, MPAs designed to facilitate certain types of activities are more effective the closer they are to ~~ports and~~ coastal access points. As a general rule, locating MPAs at the outer reaches of the maximum range of any given user group will tend to minimize the impacts on that group, both negative (loss of opportunity) and positive (creation of opportunity). MPAs that restrict users in reaching their preferred activity grounds ~~will~~ might carry higher social, economic and, potentially, safety costs.

9. Human activity patterns and portfolio effects

Human activities have distinct hotspots where effort is concentrated. For example, in the Northern California urchin fisheries economists at UC Davis have documented area based fishing strategies around a dozen fishing locations. It is likely that there are a threshold number of these locations below which the fishery would not be feasible. An MPA larger than the typical harvest area could potentially eliminate, or in the case of some non-~~consumptive~~ extractive uses like boating, diving, surfing, kayaking, educational, and scientific research create, an entire portfolio of activity sites.

10. Overall MPA and network guidelines:

- The diversity of species and habitats to be protected prevents a single optimum network design in all environments.
- To protect adult populations, MPAs should have an extent of at least 10 km and preferably 10-20km.
- To facilitate dispersal among MPAs for important fish and invertebrate groups, MPAs should be placed within 50-100 km of each other.
- Every key marine habitat should be represented in the MPA network
- MPAs that stretch from the coast to deeper water will be serve the needs of species with nursery grounds or age-related shifts in depth usage.
- For each habitat type, at least 3-5 replicate MPAs should be designed.

- Placement of MPAs should take into account local resource use and stakeholder activities to lessen impact while maintaining value.

- Heterogeneous coastal habitats and variable current regimes suggest additional MPAs around the five upwelling centers of the California coast.

Types of MPAs

The MLPA recognizes the role of different types of MPAs in achieving the objectives of the Marine Life Protection Program [FGC subsection 2853(c)]. The Marine Managed Areas Improvement Act (MMAIA) defines state marine reserve, state marine park, and state marine conservation area.

Besides somewhat different purposes, which are described below, each type of MPA represents a different level of restriction on extractive activities within MPA boundaries. These restrictions and purposes suggest how each designation can be used effectively in a system of MPAs.

- A state marine reserve prohibits taking living, geological, or cultural resources and must maintain the area "to the extent practicable in an undisturbed and unpolluted state" [PRC subsection 36710(a)]. The responsible agency may permit research, restoration, or monitoring. Such non-extractive activities as boating, diving, surfing, kayaking, research, and education may be allowed, to the extent feasible, so long as the area is maintained "to the extent practicable in an undisturbed and unpolluted state." Such activities may be restricted to protect marine resources.

- A state marine park prohibits commercial use of living or nonliving marine resources. Other uses that would compromise the protection of living resources, habitat, geological, cultural, or recreational features may be restricted. All other uses are allowed, consistent with protecting resources.

- In a state marine conservation area, activities that would compromise the protection of species of interest, the natural community[2], habitat, or geological features may be restricted. Research, education, and recreational activities, as well as commercial and recreation catches may be permitted.

The MLPA states that the preferred siting alternative for MPA networks, which the Department of Fish and Game must present to the Fish and Game Commission, must include an "improved marine life reserve[3] component" and must be designed according to all of the following guidelines:

(1) Each MPA shall have identified goals and objectives. Individual MPAs may serve varied primary purposes while collectively achieving the overall goals and guidelines of this chapter.
(2) Marine Life Reserves in each bioregion shall encompass a representative variety of marine habitat types and communities, across a range of depths and environmental conditions.

[2] Natural community is defined in Fish and Game Code section 2702(d) as: a distinct, identifiable, and recurring association of plants and animals that are ecologically interrelated.
[3] As noted above, marine life reserve in the context of the MLPA is synonymous with a no-take state marine reserve.

(3) Similar types of marine habitats shall be replicated, to the extent possible, in more than one marine life reserve in each biogeographical region.
(4) Marine life reserves shall be designed, to the extent practicable, to ensure that activities that upset the natural functions of the area are avoided.
(5) The MPA network and individual MPAs shall be of adequate size, number, type of protection, and location to ensure that each MPA meets its objectives and that the network as a whole meets the goals and guidelines of (the MLPA).

State Marine Reserves

In its definition of a "marine life reserve," the MLPA requires that "the area shall be maintained to the extent practicable in an undisturbed and unpolluted state." Elsewhere, the MLPA states that reserves "shall be designed, to the extent practicable, to ensure that activities that upset the natural ecological functions of the area are avoided." Finally, the MLPA also calls for allowing public access for ~~managed~~ non-extractive enjoyment and study, to the extent feasible. The MLPA thus requires striking a balance between protection and access in marine reserves. The form that this balance takes in an individual marine reserve will depend upon the goals and objectives of that reserve. While the MLPA specifically precludes commercial and recreational fishing from marine reserves, it also authorizes restrictions on other activities, including non-extractive activities such as boating, surfing, diving, kayaking, education and scientific ~~collection~~ research. Any such restrictions, however, must be based on specific objectives for an individual site. It is important to note that this statement does not imply that navigation will necessarily be restricted though MPAs, or that other non-extractive activities will be prohibited, although in some instances the latter may be necessary. For example, it may necessary to protect populations of sensitive marine birds or mammals in their nesting or breeding areas.

The MLPA sets other requirements for the use of marine reserves. At FGC subsection 2857(c)(3), the MLPA requires "[s]imilar types of marine habitats and communities shall be replicated, to the extent possible, in more than one marine life reserve in each biogeographical region." Consistent with this approach, this Master Plan Framework foresees that in each biogeographic region described below, all habitat types and depth zones must be represented in at least two marine reserves in order to assure the replication of habitats required by the MLPA.

State Marine Parks

As noted in Table 2 and elsewhere above, state marine parks, hereafter called "marine parks", differ from marine reserves to different degrees in their purposes as well as the type of restrictions. Unlike marine reserves, marine parks allow some or all types of recreational fishing. The types of restrictions on fishing may vary with the focal species, habitats, and goals and objectives of an individual MPA within a region. Where the primary goal is biodiversity conservation, restrictions on fishing may be different from those in an MPA where the primary goal is enhancing recreational opportunities.

Marine parks have an especially valuable role to play in designing MPAs that accommodate a spectrum of uses (NRC 2001; Salm et al. 2000). If zoning is considered in the design of MPAs

in California, plans that use all three types of MPAs may allow separation of incompatible (NRC 2001). For instance, zoning might buffer a marine reserve with a marine park in which some types of recreational fishing are regulated but allowed. In some cases, such as specialized fisheries where adult fishes or invertebrates remain in small areas, it may be possible to enlist users in the management, monitoring and enforcement of the protections enacted. On the other hand, zoning may prove to be problematic relative to the enforcement and public understanding of different regulations within contiguous areas

State Marine Conservation Areas

State marine conservation areas, hereafter called "marine conservation areas", also differ from marine reserves in their purpose as well as the type of restrictions. This type of MPA allows some level of recreational and/or commercial fishing. The restrictions on fishing may vary with the focal species, habitats, and goals and objectives of an individual MPA within a region, and may be in the form restriction on the catch of particular species or on the use of certain types of fishing gear. Marine conservation areas are particularly useful in protecting more sedentary, benthic oriented species, while allowing the harvest of migratory or pelagic species which generally do not benefit from MPAs and which are managed through fishery management plans. Another use of a marine conservation area would be to allow the continued use of traps in the sustainable commercial spot prawn fishery while prohibiting the harvest of rockfish species of concern by hook-and-line or trawl. At present the large fishery closures known as the Cowcod Conservation Area and the Rockfish Conservation Area function as de facto marine conservation areas in that bottom fishing for finfishes is prohibited but other types of fishing are allowed.

Like marine parks, marine conservation areas have an especially valuable role to play in designing MPAs that accommodate a spectrum of uses (NRC 2001; Salm et al. 2000). Similar to marine parks, zoning of marine conservation areas adjacent to marine reserves may be an option, but the potential problems cited above may apply.

In developing alternatives for MPAs in the initial central coast study region, the regional stakeholder group, the full science team and its regional sub-group, and the MLPA Blue Ribbon Task Force will develop guidance regarding the design of individual MPAs that can later be incorporated into this Master Plan Framework for application in the development of MPAs in other regions.

Setting Goals and Objectives for MPAs

Whether MPAs within a regional component of the statewide network are reserves, parks, or conservation areas, or some combination of the above, the MLPA specifies that all MPAs have certain features. First, the MLPA requires that the MLPP and each MPA in the preferred alternative have "specific identified objectives" (FGC subsections 2853[c](2) and 2857[c](1)). The MLPA provides some options for what these objectives are. At FGC subsection 2857(b), the MLPA states that MPAs may aim to achieve either or both of the following objectives:

(1) Protection of habitat by prohibiting potentially damaging fishing practices or other activities that upset the natural ecological functions of the area.

(2) Enhancement of a particular species or group of species, by prohibiting or restricting fishing for that species or group within the MPA boundary.

It is important to note that it is damaging fishing practices, not fishing per se, that is addressed in the first objective, and that both the first and second objectives may be achieved outside of the MPLA itself, as a result of other regulatory processes.

Setting goals and objectives for a regional component in the statewide network and for individual MPAs within a region will be a critical step in developing meaningful alternatives for a statewide MPA network and for individual MPAs within those alternatives, in selecting a recommended network of MPAs, and in the design of monitoring and evaluation. Assembling and evaluating available information on the biological, oceanographic, socio-economic, and governance features of a region, including existing MPAs, should precede setting regional goals and objectives. Similarly, setting regional goals and objectives should precede setting goals and objectives for individual MPAs as well as designing boundaries and management measures for individual MPAs. In addition, the process of establishing regional level goals and objectives should include stakeholder involvement.

Once set, goals and objectives will influence crucial design decisions regarding size, location, and boundaries. For instance, a marine reserve whose primary goal is protection of biological diversity may well have a different configuration than a marine reserve whose goal is enhancement of depleted fisheries (Nowlis and Friedlander 2004). Benefits for conservation of biological diversity appear to increase directly rather than proportionally with the size of reserves (Halpern 2003).

There are a variety of techniques for setting goals and objectives. No one technique is likely to suit the diverse situations in all regions.[4] Deciding upon a process for setting goals and objectives should be an early focus for regional discussions. In fashioning goals, the following characteristics should be kept in mind (Pomeroy et al. 2004).

A goal is a broad statement of intent that is:

- Brief and clearly defines the desired long-term vision and/or condition that will result from effective management of the MPA;
- Typically phrased as a broad mission statement; and
- Simple to understand and communicate.

An objective is a more specific measurable statement of what must be accomplished to attain a goal. Usually, attaining a goal requires accomplishing two or more objectives. Useful objectives have the following features:

- Specific and easily understood;
- Written in terms of what will be accomplished, not how to go about it;

[4] Reviews of MPAs around the world have identified common types of goals and objectives that may be helpful in designing individual regional networks and individual MPAs. A summary of these appears in Endnote 1.2

- Realistically achievable;
- Defined within a limited time period; and
- Can be measured and validated.

In developing regional goals and objectives, attention should be paid to other complementary programs. For instance, like the MLPA, the Marine Life Management Act (MLMA) takes an ecosystem-based approach to management. The Nearshore Fishery Management Plan (NFMP) required by the MLMA identified MPAs as an important tool in achieving its goals and objectives. While the NFMP deferred to the MLPA process in designing and establishing networks of MPAs, it also identified key features of MPA networks that would contribute to the goals and objectives of the NMFP and the MLMA. Other fishery management plans should be reviewed for similar linkages.

Once developed, regional goals and objectives can be matched with the goals of the different types of MPAs, as defined by the Marine Managed Areas Improvement Act (MMAIA) at PRC Section 36700 and in the MLPA. The MMAIA defines the goals for the three types of MPAs as shown in Table 2.

Table 2

Purpose	State Marine Reserve	State Marine Park	State Marine Conservation Area
Protect or restore rare, threatened, or endangered native plants, animals, or habitats in marine areas.	**X**		**X**
Protect or restore outstanding, representative, or imperiled marine species, communities, habitats, and ecosystems.	**X**	**X**	**X**
Protect or restore diverse marine gene pools.	**X**		**X**
Contribute to the understanding and management of marine resources and ecosystems by providing the opportunity for scientific research in outstanding, representative, or imperiled marine habitats or ecosystems.	**X**	**X**	**X**
Provide opportunities for spiritual, scientific, educational, and recreational opportunities		**X**	
Preserve cultural objects of historical, archaeological, and scientific interest in marine areas.		**X**	
Preserve outstanding or unique geological features.		**X**	**X**

Provide for sustainable living marine resource harvest.			**X**

Although the MLPA does not identify specific goals and objectives for marine parks and marine conservation areas, it does identify possible functions, which may be considered as goals, for marine reserves. At FGC subsection 2851(f), the MLPA says that marine reserves:

- protect habitat and ecosystems,
- conserve biological diversity,
- provide a sanctuary for fish and other sea life,
- enhance recreational and educational opportunities,
- provide a reference point against which scientists can measure changes elsewhere in the marine environment, and
- may help rebuild depleted fisheries.

Some or all of these functions may apply to any particular marine park or marine conservation area. For example, a conservation area which allows fishing for salmon and pelagic species could address bullets 1-3 and 5-6 by protecting all benthic species. A marine park could address bullet 4 as well as bullet 5.

As mentioned above, the MLPA recognizes that individual MPAs may have several goals and objectives, such as protection of biological diversity and enhancement of recreational opportunities. In these instances, special care should be taken in designing management measures, such as restrictions as well as data collection and monitoring, which will maximize the different objectives and quantify whether different objectives are being met.

Geographical Regions

In calling for a statewide network of MPAs, to the extent possible, the MLPA recognizes that the state spans several biogeographical regions, and identified these, initially, as follows [FGC subsection 2852(b)]:

- The area extending south from Point Conception,
- The area between Point Conception and Point Arena, and
- The area extending north from Point Arena.

In the same provision, the MLPA provides authority for the master plan team required by FGC subsection 2855(b)(1) to establish an alternate set of boundaries. The Master Plan Team convened by the Department of Fish and Game in 2000 determined that the three regions identified in the MLPA were not zoogeographic regions; scientists recognize only two zoogeographic regions between Baja California and British Columbia with a boundary at Pt. Conception. Instead of the term “biogeographical region,” the team adopted the term “marine region” and identified four marine regions:

- North marine region: California-Oregon border to Point Arena (about 183 linear nautical miles of coastline);

- North-central marine region: Point Arena to Point Año Nuevo (about 156 nautical miles of coastline);
- South-central marine region: Point Año Nuevo to Point Conception (about 203 nautical miles of coastline); and
- South marine region: Point Conception to the California-Mexico border, including the islands of the southern California Bight (about 243 nautical miles of coastline).

Three of the above four regions (those north of Pt. Conception) fall within the larger zoogeographic region accepted by scientists. These sub-regions were used more or less as subdivisions of the greater zoogeographic region by the former MPT. Technically, the requirement of replicate state marine reserves encompassing a representative variety of habitat types and depths would only apply to the two recognized zoogeographic regions within the state. However, based on the concept of a network of MPAs, in whatever way it is defined, and the fact that it would likely require unusually and unacceptably large SMRs to incorporate a wide variety of habitat types if only two (the minimum definition of "replicate") SMRs were established in each zoogeographic region, it is likely that a statewide network will contain more than two SMRs in each bioregion.

Based on this review, there are three possible definitions of the biogeographic regions that will serve as the basic structure of the statewide network of MPAs. These options are as follows:

1) The three biogeographic regions defined in the MLPA;
2) The two biogeographic regions recognized by many scientists; and
3) The four marine regions identified by the Master Plan Team convened by the Department of Fish and Game.

Consideration of Habitats in the Design of MPAs

The first step in assembling alternative proposals for MPAs in a region is to use existing information to the extent possible to identify and to map the habitats that should be represented. The MLPA also calls for recommendations regarding the extent and types of habitats that should be represented.

The MLPA identifies the following habitat types: rocky reefs, intertidal zones, sandy or soft ocean bottoms, underwater pinnacles, sea mounts, kelp forests, submarine canyons, and seagrass beds. The Master Plan Team reduced this basic list by eliminating sea mounts, since there are no sea mounts in state waters. The team also identified four depth zones as follows: intertidal, intertidal to 30 meters, 30 meters to 200 meters, and beyond 200 meters. Several of the seven habitat types occur in only one zone, while others may occur in three or four zones.

The Science Advisory Team recommends expanding these habitat definitions by recognizing that habitat is not simply defined by the substrate. Marine habitats are also characterized by their water column characteristics, which create the climatic aspects of marine habitats. Just as a sand dune at the beach and a sand dune in the dessert are not the same habitats, rocky reefs in different oceanographic settings differ fundamentally in ways that affect the species that use the reefs. Three special habitats driven by oceanographic conditions were singled out:

- Centers of upwelling, which are typically associated with major points and headlands;

- Salinity plumes, which are associated with streams and rivers; and
- Retention features, which are areas characterized by restricted ocean currents such as gyres, eddies, or regions in the lee of headlands.

Experience in California and elsewhere demonstrates that individual MPAs generally include several types of habitat in different depth zones, so that the overall number of MPAs required to cover the various habitat types can be relatively small. The Master Plan Team also called for considering adjacent lands and habitat types, including seabird and pinniped rookeries. However, it should be noted that marine birds and mammals are protected by federal regulations and they are not a primary focus of the MLPA.

Recommending the extent of habitats that should be included in an MPA network will require careful analysis and consideration of alternatives. These recommendations may vary with habitat and region, but should be based on the best readily available science. One aspect of determining appropriate levels of habitat coverage is the habitat requirements of species likely to benefit from MPAs in a region. At FGC subsection 2856(a)(2)(B), the MLPA requires that the Master Plan identify "select species or groups of species likely to benefit from MPAs, and the extent of their marine habitat, with special attention to marine breeding and spawning grounds, and available information on oceanographic features, such as current patterns, upwelling zones, and other factors that significantly affect the distribution of those fish or shellfish and their larvae."

Species Likely to Benefit from MPAs

Recommending the extent of habitat that should be included in an MPA network will require careful analysis and consideration of alternatives. These recommendations may vary with habitat and region, but should be based on the best readily available science. One aspect of determining appropriate levels of habitat coverage is the habitat requirements of species likely to benefit from MPAs in a region. At FGC subsection 2856(a)(2)(B), the MLPA requires that the Master Plan identify "select species or groups of species likely to benefit from MPAs, and the extent of their marine habitat, with special attention to marine breeding and spawning grounds, and available information on oceanographic features, such as current patterns, upwelling zones, and other factors that significantly affect the distribution of those fish or shellfish and their larvae."

DFG prepared a master list of such species, which appears in Appendix B. This list may serve as a useful starting point for identifying such species in each region during the development of alternative MPA proposals. With the assistance of the SAT, the Department should develop a list of species specific to each study region of the state, as they are determined, for use by the appropriate RSG. This regional list then can assist in evaluating desirable levels of habitat coverage in alternative MPA proposals. Although the statewide list will be all inclusive, it is not likely that all species on the list will benefit from the establishment of new, or the expansion of existing, MPAs. For example, a species may be in naturally low abundance within this portion of its geographical range.

Enforcement and Public Awareness Considerations in Setting Boundaries

Regardless of the amount of enforcement funding, personnel or equipment available the enforceability and public acceptance and understanding of marine protected areas will be enhanced if a number of criteria are considered during design and siting. While the complexities of the California coastline and locations and distributions of protected habitats and resources make using the same criteria at each location difficult, an effort should be made to include as many of these considerations as possible.

Marine protected area boundaries should be clear, well-marked, recognizable, measurable and defensible. Selecting known, easily recognizable landmarks or shoreline features, where possible, as starting points for marine protected area boundaries will provide a common, easily referenced understanding of those boundaries. In general, marine protected area boundaries should be straight lines that follow whole number North-South and East-West coordinates wherever possible. Likewise, any offshore corners or boundary lines should be located at easily determined coordinates. This is especially true if installation and maintenance of boundary marker buoys is not cost effective or feasible. Using depth contours or distances from shore as boundary designations should be avoided, if possible, due to ambiguities in determining exact depths and distances. However, in some cases, depth boundaries may be not only unavoidable but desirable. Many of California's existing MPAs in ocean waters use depth as the offshore boundary. This is a practical concession based on the use by divers who possess depth gauges but no other navigational aids. In the case of a proposed intertidal MPA, for example, depth would be the only practical alternative for an offshore boundary.

There are benefits and disadvantages to siting marine protected areas in locations that are accessible and/or observable, either from the shore or the water. On one hand they~~,~~ can increase the likelihood that potential illegal activities will be observed and reported, thereby discouraging such activities because they might be observed and increase public awareness of the MPA.

Conversely, MPAs sited in areas that are very easily accessed will naturally have higher potential for illegal activities to occur. Additionally, these areas will have the highest level of conflict with existing uses. Siting MPAs in areas close to harbors may raise issues of safety and convenience by requiring extractive users to travel farther to areas open to fishing could be problematic. Siting must be balanced between the ease of enforcement and monitoring and the potential for infractions to occur. If enforceable alternative areas are available farther from easy access points, they should be considered.

Siting marine protected areas within, or near, locations under special management (national marine sanctuaries and parks, state and local parks and beaches, research facilities, museums and aquaria, etc) may provide an added layer of enforcement, observation and public awareness. This is especially true if there are shore-side facilities and personnel based at the site.

Information Supporting the Design of MPAs

Throughout the development of alternative proposals for MPAs, an emphasis must be placed upon using the best readily available science, as required at FGC subsection 2855(a). The

MLPA does not require complete or comprehensive science, but rather the level of science that is practicable.

Baseline data needs for MPAs should be drafted for inclusion in the regional MPA management plan described elsewhere in the Master Plan Framework (see Endnote 3.1). Examples of such needs are:

- Status of recreational, commercial, and other marine resources in the region;
- Status of species in need of restoration;
- Analysis of extractive or other potentially harmful activities affecting living marine resources in the region, including commercial and recreational fishing~~, diving~~, point and non-point discharges, off shore oil spills, etc;
- Geographical patterns of extractive and non-extractive uses;
- Economic contribution of ocean-dependent activities to local and regional economies.

Additional types of baseline information needs will be identified during the central coast study region process.

This process should also draw upon the knowledge, values, and expertise of local communities and other interested parties. At FGC subsection 2855(c)(1)-(2), the MLPA specifically requires that local communities and interested parties be consulted regarding:

(1) Practical information on the marine environment and the relevant history of fishing and other resources use, areas where fishing is currently prohibited, and water pollution in the state's coastal waters.
(2) Socioeconomic and environmental impacts of various alternatives.

As described in the "Strategy for Stakeholder and Interested Public Participation" adopted by the MLPA Blue Ribbon Task Force (Appendix G), there are a variety of methods and activities for meeting these requirements. More generally, as the process for developing MPA alternatives gets underway in each region, a regional group of stakeholders will be convened.

Other Programs and Activities Other Than Fishing

Regional and planning site profiles should describe current and anticipated non-extractive human activities that may affect representative habitats and focal species. These activities might include ~~aquatic activities, such as fishing and~~ boating, surfing, diving, kayaking, education, scientific research as well as terrestrial, such as development ~~and those activities~~ which as a consequence may cause non-point and point-source discharges. Management of any activities that affect the species that may benefit from MPAs as well as representative habitats ~~sh~~could then be assessed in relation to the goals and objectives of the MLPA.

The California Ocean Protection Act (COPA, 2004) is another complementary program that should be considered. The act encourages the use of private and charitable contributions to develop the ocean protection and conservation strategies. This is very similar to the MLPA Initiative process. Additionally, one of COPA's objectives is to "provide for public access to the

ocean and ocean resources, including to marine protected areas, for recreational use, and aesthetic, educational, and scientific purposes, consistent with the sustainable long-term conservation of those resources." This similar goal to the MLPA enhances the need for long-term sustainability while allowing compatible use. It is important to note that COPA does not change existing laws, but only provides a mechanism for coordinating and integrating those laws, and for recommending future legislative changes where necessary.

In addition, other programs exist which provide environmental protection without directly protecting marine species through restrictions on take. For example, the Monterey National Marine Sanctuary has an overall goal of ecosystem protection and its regulations, among other things, prohibit oil and gas exploration, mining, and alteration of the seabed, regulating cruise ship discharges, and restricting over flights. The State Water Resources Control Board regulates all point source discharges to ocean waters and requires monitoring at the near outfalls. These need to be recognized in any potential proposals for MPAs.

Section 3. Management

Without effective management, MPAs and MPA networks become “paper parks,” and their goals, objectives, and benefits are not achieved (Kelleher et al. 1995). As a result, the array of MPAs creates the illusion of protection while falling far short of its potential to protect and conserve living marine life and habitat “(FGC Section 2851[a]). Consistent with this concern, one of the goals of the Marine Life Protection Program mandated by the MLPA is “[t]o ensure that California's MPAs have clearly defined objectives, effective management measures, and adequate enforcement, and are based on sound scientific guidelines” (FGC Section 2853[b]5). Among the required elements of the program are “[s]pecific identified objectives, and management and enforcement measures, for all MPAs in the system” (FGC Section 2853[c]2). Finally, the MLPA requires that the system of MPAs established under the Marine Life Protection Program be managed adaptively through effective monitoring, research, and evaluation in selected areas and through adequate funding (FGC Section 2856[a]2[H and K]).

The initial focus for meeting the management requirements of the MLPA should be the preparation of a management plan for each potion of the MPA network. Besides guiding day-to-day management, research, education, enforcement, monitoring, and budgeting, a management plan also distills the reasoning for key elements of the network that should be monitored, evaluated, and revised in response to new information and experience. Much of the material required to complete this management plan will be developed in the course of designing, evaluating, and establishing a specific MPA proposal which is based largely on the Outline of Information Required for Proposals for Alternative Networks of Marine Protected Areas in Appendix D. Some elements of management, such as monitoring and evaluation, enforcement, and financing, are described in more detail elsewhere in this Master Plan.

Budgets should be linked to these targets, activities, objectives, and goals, and be based upon a range of costs and revenues reflecting expressed assumptions about revenues. Budgets should identify necessary and desirable staff positions and funding for administration, education and interpretation, coordination of research and monitoring, and enforcement, as well as capital and operational costs for such assets as facilities, boats, and vehicles.

Management plans should not dwell upon detail, but should provide a foundation for developing more specific action plans, as necessary, and for adapting management measures to new information. Management plans should include a schedule for review and possible revision at least every five years, and a mechanism for revisions in the interim in response to significant events, such as unexpected monitoring results, budget shifts, or changes in the status of the populations of focal species or of habitats or in the character or effectiveness of management outside individual MPAs.

A management plan should describe the allocation of responsibility to various government agencies and non-government organizations for carrying out specific management activities including those partnerships that could result in more effective and economical management of the MPA. While the California Department of Fish and Game, and in some circumstances the California Department of Parks and Recreation, exercise primary authority for the management of California’s MPAs, these agencies can draw upon each other and upon the capacity of other agencies and organizations in carrying out critical management activities. MPAs located

adjacent to facilities such as marine labs, onshore protected areas, or similar such institutions may be effectively co-managed by those entities.

In meeting needs for research, monitoring, enforcement, and public education activities, MPA proposals should look to collaboration with federal agencies. An example is the collaboration with the Channel Island's National Marine Sanctuary and the National Park Service at the MPAs established in 2003 around the Channel Islands. In some cases, such collaboration will benefit from a formal memorandum of understanding, while in other cases collaboration can be most effectively pursued at more informal levels.

Collaboration with non-governmental organizations, including non-profit conservation and education organizations, yacht clubs, and fishermen's or recreational divers' groups, can enhance implementation of important management activities, such as education, research, and monitoring. At the Monterey Bay National Marine Sanctuary, for instance, the Citizen Watershed Monitoring Network, a volunteer-based group, conducts monitoring according to USEPA standards. While this data is voluntarily collected and therefore may not be used for enforcement purposes, it does provide several benefits to the sanctuary that would otherwise not have the staff or funding to support such data collection. Commonly, lack of organizational capacity inhibits such cooperative ventures with stakeholder and community groups (Weber and Iudicello Martley 2004).

Engagement with local communities can be particularly important in building support for and compliance with regulations (NRC 2001). The MLPA recognizes the importance of doing so at FGC Section 2855(c), which requires that in preparing the master plan, DFG solicit local communities for information on several issues, including the design of monitoring and evaluation activities, and methods to encourage public participation in the stewardship of the state's MPAs. To this end, DFG has commonly convened stakeholder committees to advise in the development of management plans for fisheries and other management activities such as the Channel Islands Marine Protected Areas or the regional working groups in the previous phase of MLPA implementation. Some form of state-wide MPA Advisory Committee may be able to serve a valuable function to insure a continuing linkage between public and governmental participants as the MLPA is implemented throughout the state.

As noted earlier in this document, designing and evaluating alternative MPA proposals in individual regions will benefit from the advice and involvement of working groups of stakeholders from the region in which the proposal is being developed. Such groups would not focus on just one MPA in a region, but be involved in the planning (and eventual management) of the MPAs that form the portion of the network in that region. While these regional processes would rely on input and participation from stakeholders and others with interests in those regions, input from other interested parties from outside the region would also be considered since many coastal resource users are from non-coastal areas. Regional processes would, by their nature, have a local focus and consider regional MPA components that reflect the local conditions, patterns of use, and resource status within the overall state-wide framework and criteria for MPAs as called for in the MLPA. Care must be taken to ensure that these groups represent the range of interests in the region and that the charter of the group and its role in the overall process of network design and evaluation is clear from the outset. It is important, for example, that the charter of any regional stakeholder group focus on

implementation of state law and plans. To that end, the state goals to be achieved regionally should be clearly stated in the charter.

Stakeholder advisory committees should continue to play a role in the management of MPAs in a region. The management plan for a regional MPA proposal should provide for continuing engagement of stakeholders through a regional advisory committee (Salm et al. 2000). Such a committee can fulfill a number of important roles, such as those stated in the recent National Report of the National Marine Sanctuary Program's Advisory Councils (NMSP 2004):

- Serve as a link between an MPA and its community, disseminating information about the MPA to the various constituencies of members and bringing the concerns of constituents and the public to sanctuary staff;
- Assist in creating a dialogue to examine various sides of an issue and a place for mediation;
- Identify potential partners and constituent groups with which the MPA should be working and forge relationships;
- Review and provide input on plans, proposals, and products, including prioritizing issues;
- Provide technical and background information on issues facing the MPA; and
- Validate the accuracy and quality of information used for decision making.

Key issues in convening an effective advisory committee include size and structure, such as whether to convene an overall committee within which sub-groups of the committee or working groups of non-committee members operate. As is the case with stakeholder committees advising on the design and evaluation of proposed MPAs, the charter of the stakeholder committees convened after establishment of MPAs must be clear. The role of such committees may range from simply advising the Department of Fish and Game to conducting specific management tasks under the general guidance of DFG (Pomeroy and Goetze 2003).

Section 4. Enforcement

The MLPA identified the lack of enforcement as one of the chief deficiencies in California's existing MPAs (FGC Section 2851[a]). To remedy this deficiency, the MLPA requires that the Marine Life Protection Program provide for adequate enforcement [FGC Section 2853(b)(5)] and include enforcement measures for all MPAs in the system [FGC Section 2853(c)(2)].

This section of the Master Plan Framework addresses these requirements by responding to two requirements for the master plan identified at FGC Section 2856(a)(2):

> (I) Recommendations for management and enforcement measures for the preferred alternative that apply system wide or to specific types of sites and that would achieve the goals of this chapter.
>
> (J) Recommendations for improving the effectiveness of enforcement practices, including, to the extent practicable, the increased use of advanced technology surveillance systems.

Any new, modified or existing marine protected areas will only be effective if their regulations are widely accepted, understood and adhered to by the public. To that end, the first requirement of effective enforcement of restrictions in the network of marine protected areas is solicit the input and participation of stakeholders in the first stages of MPA design. Where possible, it will also be important to enlist user communities in protecting the designated protected areas. In some contexts, such as specialized fisheries or recreational fishermen allowed access to marine conservation areas and/or parks, or non-~~consumptive~~ extractive users allowed access to marine reserves, enlisting those users in enforcement of their protected status will be important.

DFG's enforcement staff is charged with enforcing marine resource management laws and regulations over an area encompassing approximately 1,100 miles of coastline and out to sea for 200 miles. DFG currently deploys 50 law enforcement officers statewide (still well below the staffing level of the 1980's) who focus on the marine environment. Of these 50 officers, 21 are dedicated to on water patrols utilizing patrol vessels as enforcement platforms. DFG has two 65-foot patrol vessels, five new 54-foot vessels and two 40-foot vessels, all of which can patrol wide areas including offshore waters and islands. These large patrol vessels are equipped with 18-foot rigid hull inflatable skiffs. DFG also has 21 skiffs (13-32 feet) for local patrols. Patrol vessels and skiffs are strategically stationed at various ports and other locations to provide the most effective coverage of California's marine waters. DFG also maintains patrol aircraft that are available when needed to assist with marine enforcement activities.

DFG's enforcement program also has cooperative agreements with several federal agencies (National Marine Sanctuary Program and National Marine Fisheries Service) which provide added funds to DFG's enforcement program for operations and personnel dealing with Federal regulations and patrols in Federal waters. These kinds of relationships are likely to continue, and may increase, as other federal agencies enter into similar agreements with DFG. DFG's enforcement program also works closely with the enforcement programs of a number of other governmental agencies (California Department of Parks and Recreation, National Park

Service, U.S. Coast Guard, local harbor patrols and local police and sheriffs departments) on matters of mutual enforcement interest. During the regional MPA planning process the enforcement resources available in that area and any gaps or limitations to effective enforcement in that area will be identified. This will not only make planning for MPAs in the region more realistic, but also provide a basis for seeking more enforcement resources, if needed.

Enforcement of current marine protected area regulations is one of many responsibilities for DFG's enforcement program. A new system of marine protected areas is likely to require additional enforcement effort; however, it is uncertain whether significant new sources of funding, personnel and equipment will be available to provide dedicated enforcement for those areas. If additional resources become available, they will most likely provide for increased attention to marine protected areas as part of the overall marine resources enforcement effort.

Regardless of the amount of enforcement funding, personnel or equipment available the enforceability and public acceptance and understanding of marine protected areas will be enhanced if a number of criteria are considered when they are being designed and sited. These criteria are discussed in Section 2 regarding the design of MPAs.

Once marine protected areas have been designed, sited and established, there are a number of strategies that can be followed to increase public acceptance and understanding, and enforcement effectiveness for these areas.

One effective strategy to increase compliance with marine protected area regulations is to make use of other management entities which may have some control of, interest in or presence at the site, or to encourage these entities to include the presence of such an area in their programs. In most cases, marine protected area status is consistent with the mission of these entities and they will view it as an opportunity for their programs. They will often have educational, interpretive and volunteer programs and facilities in place whose purpose is to increase public knowledge of the area's special status. These kinds of programs lend themselves well to communicating information about marine protected areas to the public. Some of these entities will also have their own enforcement staffs that can provide an added frequent on-site presence as well. Formal or informal cooperative agreements between the Department and these entities for enforcement and public information activities may further improve compliance with marine protected area regulations.

Enforcement personnel recommend the use of straight-line boundaries based on latitude/longitude coordinates wherever possible. Such a system can easily be designed to encompass considerations of ecosystem, community, habitat or use patterns while still making enforcement and public knowledge of the boundaries as clear as possible. These boundaries facilitate enforcement as well as providing clear and understandable edges to the public. Using due north-south and east-west boundary lines allows for simple mapping and display of the areas. Straight lines are preferable to a specified distance offshore or depth contour as they are easier to determine on the water. While determining distance offshore requires the use of radar, which is fairly expensive, and depth contours require the use of sonar, which will vary with the unit's calibration and the tide, latitude/longitude coordinates are easily and accurately measured with global positioning systems (GPS). GPS is not only accurate, but affordable and

portable when compared to radar and sonar. Enforcement personnel also recommend that boundaries be based on clear landmarks that are easily defined on maps and seen from the water. In combination, these techniques provide boundaries which are relatively understandable and enforceable.

Another strategy is to use clear and consistent signage and boundary markers at the site that easily communicate that the area has a special status. Marine protected areas with defined access points (parking lots, visitor centers, stairways, etc) lend themselves well to this strategy. Sign design (shape, color, logos) should be unique, easily recognizable and consistent for similar types of marine protected areas. Sign text should be concise and easily convey the level of protection for the site while briefly describing the benefits of increased protection. To further increase public understanding and reduce confusion, the level of protection and its description should be the same for each category or type of marine protected area. For offshore situations, distinctive buoys marking boundary locations might be used where feasible and cost effective.

The use of surveillance and monitoring technologies could play a more important role in the future of marine protected area enforcement. These technologies include the following:

- Vessel monitoring systems (transponders) are already used in a number of areas world-wide, and are becoming required for more fisheries along the California coast, to track the location of commercial fishing vessels and ensure that they avoid specific fishery closure areas. This is especially useful for large areas which are remote, far offshore or difficult to observe consistently. This technique has not been applied to recreational vessels and would require significant changes in current regulation to do so.

- Night vision equipment is readily available and being used more frequently in marine enforcement activities. Since violators of marine protected area regulations may chose to operate at night in an attempt to avoid detection, this type of equipment could prove very useful in these areas.

- Radar which is linked with global positioning equipment and based on patrol vessels or aircraft can now provide accurate location information for suspected fishing vessels which may be operating in or near marine protected areas. Such accurate position information can greatly strengthen prosecution against those charged with violating marine protected area regulations.

- Remote camera systems may also play a future role in marine protected area surveillance. Locations which have permanent facilities such as service buildings, visitor centers or other structures could provide the infrastructure necessary to support video cameras which could send images directly to monitoring centers or to Internet websites (web cams). Images from such remote cameras could be monitored on a regular or random basis or more intensively if illegal activity is suspected or imminent.

The principal recommendations of this Master Plan Framework regarding enforcement and the use of advanced technology are as follows (not in order of priority):

- Seek additional State resources to support enforcement needs resulting from a comprehensive network of MPAs. Focus this support on the need for additional staff to monitor activities within MPAs.

- Make use of cooperative efforts and agreements with other agencies interested in marine protected areas to provide increased enforcement presence at those locations.

- Make increased use of current and new technologies to enhance surveillance and enforcement effectiveness in marine protected areas.

- Insure, to the extent practical, that new marine protected areas are designed and sited to maximize simplicity and recognition of boundaries, are observable, are linked to other governmental entities with interests in these areas and are large enough to provide protective buffers around any sensitive habitats or resources.

- Support and encourage the development of local information and education programs designed to increase public understanding and acceptance of marine protected areas as a positive resource management measure.

- Insure that signage and boundary markers, when used, are understandable, recognizable, and provide consistent information for similar areas.

- Include enforcement efforts focusing on marine protected areas as an integral component of the overall marine enforcement program.

Section 5: Monitoring and Evaluation of MPAs

In the last several decades, monitoring and evaluation have become important features of management approaches to living marine resources and the environment (NRC 1990). More recently, they have become central elements in management programs intended to adapt as understanding of the managed ecosystems – both the biophysical and social systems – improves and circumstances change. In California, the Legislature incorporated this adaptive approach into the Marine Life Management Act (MLMA) in 1998. Besides defining adaptive management, the MLMA requires the development of research and monitoring activities within fishery management plans [FGC Sections 90.1, 7073(b)(3), and 7081].

A year later, the Legislature incorporated the principle of adaptive management as well as monitoring and evaluation of MPAs and MPA network components into the Marine Life Protection Act (MLPA):

- At FGC Section 2853(c)(3), the MLPA requires that the Marine Life Protection Program include "[P]rovisions for monitoring, research, and evaluation at selected sites to facilitate adaptive management of MPAs and ensure that the system meets the goals stated in this chapter."

- FGC Section 2852(a) uses the definition of adaptive management first used in the MLMA: "'Adaptive management,' with regard to marine protected areas, means a management policy that seeks to improve management of biological resources, particularly in areas of scientific uncertainty, by viewing program actions as tools for learning. Actions shall be designed so that, even if they fail, they will provide useful information for future actions, and monitoring and evaluation shall be emphasized so that the interaction of different elements within marine systems may be better understood."

- At FGC Section 2856(a)2(H), the MLPA requires that the Master Plan include "[R]ecommendations for monitoring, research, and evaluation in selected areas of the preferred alternative, including existing and long-established MPAs, to assist in adaptive management of the MPA network, taking into account existing and planned research and evaluation efforts."

- Finally, FGC Section 2855(c)3 requires that in developing the Master Plan, the Department and team solicit comments and information from interested parties regarding a number of issues, including the design of monitoring and evaluation activities.

In these and other ways, the MLPA emphasizes the role of monitoring and evaluation in adapting individual MPAs and MPA network components in response to new knowledge and circumstances. In doing so, the MLPA reflects state of the art practice and expert opinion (NRC 2001). It is worth noting that the MLPA calls for monitoring and evaluation of selected areas within the preferred alternative to assist with adaptive management of the MPA network. This does not mean that other MPAs would not also be monitored and evaluated in

accordance with their own goals and objectives, but that the performance of selected MPAs might be used to guide future decisions over a wider area. Nevertheless, monitoring and evaluation is not done for its own sake, but to gauge the performance of an MPA in relation to its goals and objectives. A cost effective approach in many areas may be to link or include these activities to other similar ones already in place or being conducted by other entities nearby. Similarly there may be many opportunities to involve stakeholders and members of the general public in monitoring and evaluation activities as well, thus leveraging further the resources available.

Since MPAs will be phased in individual regions through 2011 rather than adopted all at once statewide, the initial focus must be on developing effective monitoring programs in individual regions, including monitoring in areas both inside and outside MPAs. As these programs yield results, experience should lead to the revision of this document for use in later regions. The final phase in developing monitoring and evaluation programs will be to evaluate and adjust these programs in individual regions to reflect a coherent program statewide. The phased approach to implementing the MLPA state-wide will also allow the results of the earlier monitoring and evaluation programs to enlighten and improve the actual design and placement of future MPAs in other regions.

Meeting the MLPA's standards regarding adaptive management should begin with developing management plans, as described elsewhere, that identify explicit ecological and socioeconomic goals for each MPA that align with the intent of the MLPA. Specific measurable objectives should be identified that can be used to evaluate progress towards these MPA goals and should include the input and active involvement of stakeholders and scientists. In light of the adaptive management approach, the MLPA provides for future proposals to add, modify, or eliminate MPAs based on information gained from monitoring and evaluation activities, the development of new scientific information, and the input from interested parties. A statewide public MPA Advisory Committee could function productively in this part of the process.

Clear and measurable objectives should, in turn, form the basis for the design of systems to monitor and evaluate the impacts of management actions. Monitoring and evaluation systems should explicitly address five principles (Pomeroy et al. 2004). Such programs should be:

- Useful to managers and stakeholders for improving MPA management;
- Practical in use and cost;
- Balanced to seek and include scientific input and stakeholder participation;
- Flexible for use at different sites and in varying conditions; and
- Holistic through a focus on both natural and human perspectives.

Adaptive management also requires a feedback loop through which monitoring results inform management decisions. Through this process the MPA network objectives, management plans, and monitoring programs are adjusted in response to new information and circumstances (Pomeroy et al. 2004; NRC 1990). To this end, management plans for portions of the MPA network should specify methods and timing for reporting and incorporating the results of monitoring and evaluation programs into management decisions *before* monitoring programs are developed and implemented.

Effective monitoring and evaluation programs can assess whether actions taken have produced the desired results and other benefits (Pomeroy et al. 2004). For instance, such programs can assess whether resources expended in management have been effective and consistent with policy and management goals, and have yielded progress toward goals and objectives. Appropriately defined benchmarks provide useful quantified measures of progress toward a goal at specified stages. The results from such activities can increase understanding and confidence among stakeholders in existing management measures or the need for changes in management. Monitoring and evaluation can generate the kind of information that decision makers seek when considering requests for additional resources. Well-designed monitoring and evaluation programs also can build understanding about the structure and function of the managed ecosystem, and thereby improve the knowledge base for future management decisions.

These results should be reviewed and vetted publicly and at regular intervals. One way to do this would be to use a standing advisory group as discussed on page 31. An important role for stakeholder advisors would be to provide input, from their perspective, as to whether MPAs were meeting their goals.

Well designed and implemented monitoring and evaluation plans should also be able to identify those changes that are the results of processes and events beyond the influence of the MPAs as well as the actual performance of the MPAs. This would help managers to make appropriate decisions about future management action that might be needed and limit the chance of making decisions on incomplete information and unnecessarily committing fiscal resources to unproductive activities.

Many of the recommendations that follow largely come from a 2004 guidebook to natural and social indicators for evaluating MPA management effectiveness (Pomeroy and others 2004). This discussion relies heavily on this guidebook because it is comprehensive, reflects the experience of MPAs around the world, has been field tested, and relies principally upon techniques that are simple rather than complex, and therefore more likely to be implemented and sustained over the long term.

The discussion below presents only the more general features of the approach presented in the guidebook; much more detail is available in the guidebook itself. In addition, monitoring and evaluation programs should reflect local conditions, constraints, and opportunities.

Developing a Monitoring and Evaluation Program for MPAs and Network Components

To promote consistency among monitoring and evaluation programs in different regions, developers of regional MPAs should follow the sequential process outlined below. Parallel processes are likely to eventually be undertaken at a statewide level to enable adaptive management of California's system of MPAs and MPA network as a whole. Note that the first step – the clear articulation of goals and measurable objectives – is critical for developing a useful monitoring and evaluation program for an individual MPA or a portion of the MPA network.

The principal steps of the Master Plan Framework process follow. Any departure from this process should be noted and justified.

- Identify MPA goals and objectives.
    - Identify any overlapping goals and objectives.
- Select indicators to evaluate biophysical, socio-economic, and governance patterns and processes
    - Review and prioritize indicators,
    - Develop quantifiable benchmarks of progress on indicators that will measure progress toward goals and objectives, and
    - Identify how selected indicators and benchmarks relate to one another.
- Plan the evaluation.
    - Assess existing data;
    - Assess resource needs for measuring selected indicators;
    - Determine the audiences to receive the evaluation results;
    - Review relevant monitoring and evaluation programs at existing MPAs, such as at the Channel Islands;
    - Identify participants in the evaluation; and
    - Develop a timeline and work plan for the evaluation.
- Review and revise planned monitoring and evaluation program.
    - Conduct structured peer and public review processes, and
    - Make modifications in response to review.
- Implement the evaluation work plan.
    - Select methods and approach and collect data;
    - Manage collected data, includes identifying the data manager, providing for the long-term archiving and access to the data, and making the data available for analysis and sharing;
    - Analyze collected data; and
    - Conduct peer review and independent evaluation to ensure robustness and credibility of results.
- Communicate results and adapt management.
    - Share results with target audiences, and
    - Use results to adapt management strategies.

To achieve the purpose of informing adaptive management, the results of monitoring and evaluation must be communicated to decision makers and the public in terms that they can understand and act upon (NRC 1990). Moreover, in addition to aiding in MPA management, measuring, analyzing and communicating indicators can promote learning, sharing of knowledge and better understanding of MPA natural and social systems among scientists, resource managers, stakeholders, members of the public, and other interested parties (Pomeroy et al. 2004). To these ends, monitoring and evaluation programs for MPAs should include a communications plan that identifies the target audiences and specifies the timing, methods, and resources to regularly synthesize and present monitoring and evaluation results.

Though the results from ongoing monitoring and evaluation should be reviewed periodically, a comprehensive analysis of monitoring results should be conducted every three to five years.

The longer time-frame for review takes into account the fact that biological changes are slow to occur and trends are more likely to become apparent on this time scale. These reviews should be transparent, include peer review, and make results available to the public. Besides evaluating monitoring methods and results, the review should evaluate whether or not the monitoring results are consistent with the goals and objectives of the individual MPA, the region, and the MLPA. If the results are not consistent, the review should develop recommendations for adjustments in the management of the MPA network.

Within the above set of required components, the Master Plan Framework does not prescribe specific monitoring methods. For example, monitoring and evaluation programs may be effective within a range of levels in intensity and sampling frequencies. They also may rely on different indicators, depending on the MPA goals and objectives. Useful guidance on the selection of indicators can be found in Pomeroy et al. (2004).

General Considerations in Identifying Indicators

An indicator measures the success of a management action, such as the specific design of an MPA. It is a unit of information measured over time that will make it possible to document changes in specific attributes of the MPA (Pomeroy et al. 2004). General considerations in selecting or designing an indicator, include:

- Measurable - able to be recorded and analyzed in quantitative or qualitative terms.
- Precise - clear meaning, with any differences in meaning well understood OR measured the same way by different people.
- Consistent - not changing over time, but always measuring the same thing.
- Sensitive - changing proportionately in response to actual changes in the variables measured.
- Simple - rather than complex.
- Independence defined - correlation with other indicators examined.

The Master Plan Framework requires MPA monitoring and evaluation programs to measure biophysical, socio-economic, and governance indicators, since these dimensions of marine ecosystems are inextricably linked (Pomeroy et al. 2004). Text below provides examples of possible indicators.

Biophysical. One common focus of MPAs is the conservation of the living marine resources and habitats of California's coastal waters. Likely biophysical goals of individual MPAs established under the MLPA include sustaining the abundance and diversity of marine wildlife, protecting vulnerable species and habitats, and restoring depleted populations and degraded habitats. Thus, potential biophysical indicators might include (Pomeroy et al. 2004):

- Abundance and population structure of species of high ecological or human use value;
- Composition and structure of a community of organisms;
- Survival of young;
- Measures of ecosystem condition;
- Type and level of return on fishing effort;

- Water quality; and
- Areas whose habitat or wildlife populations are showing signs of recovery.

Socio-economic. Socioeconomic indicators make it possible to understand and incorporate the concerns and interests of stakeholders, to determine the impacts of management measures on stakeholders, and to document the value of an MPA to the public and to decision makers (Pomeroy and others 2004).

Possible socio-economic indicators include (Pomeroy et al. 2004):

- Use data (and values of those uses) for consumptive and non-consumptive purposes, including:
    - Numbers of participants
    - Economic effects on local communities and to supporting industry
    - Measures of perceived value and level of satisfaction derived from consumptive and non-consumptive activities
    - Changes in geographic and other patterns of use in and around MPAs within the region;
- Level of understanding of human impacts on resources;
- Perceptions of non-market and non-use value;
- Community infrastructure and business;
- Number and nature of markets; and
- Shareholder knowledge of natural history and current use patterns and intensity.

All of these indicators would be tailored and specifically defined to reflect the conditions, resources present, use patterns and goals and objectives of each MPA or portion of the MPA network.

Governance. By definition, MPAs are a governance tool since they limit, forbid, or otherwise control how people use marine areas and wildlife through rights and rules (Pomeroy and others 2004). Governance may include enforcement, use rights, and regulations. Goals for governance of MPAs include the following (Pomeroy et al. 2004):

- Legal certainty as indicated by legal challenges or reported failure to act because of legal uncertainty;
- Effective management structures and strategies maintained;
- Effective legal structures and strategies for management maintained;
- Effective stakeholder participation and representation ensured;
- Management plan compliance by resource users enhanced; and
- Resource use conflicts managed and reduced.

Possible governance indicators include the following:

- Local understanding of MPA rules and regulations;
- Availability of MPA administrative resources;
- Existence and activity level of community organizations;

- Level of stakeholder involvement; and
- Clearly defined enforcement procedures.

In selecting indicators, a monitoring and evaluation plan for an MPA or portion of the MPA network should (Pomeroy et al. 2004):

- Define and provide a brief description of the indicator;
- Explain the purpose and rationale for measuring the indicator;
- Consider difficulty and utility—that is, how difficult it is to measure and the relative usefulness of information provided by the indicator;
- Evaluate the required resources including people, equipment, and funding;
- Specify the method and approach to collecting, analyzing, and presenting information on the indicator, including sample size, spatial and temporal variation;
- Identify reference points or benchmarks against which results will be measured and timelines within which changes are expected;
- Explain how results from measuring the indicator can be used to better understand and adaptively manage the MPA;
- Provide references on methods and previous uses of the indicator.

Prior knowledge of the variability in the indicators selected should be incorporated into the monitoring and evaluation design where possible. If no prior knowledge exists variation in indicators must be identified within the monitoring and evaluation program. Multiple independent indicators are required for complex systems such as in the marine environment.

Finally, it is important to recognize the role that volunteer monitoring activities can play in evaluation. As mentioned earlier, there may be many opportunities to leverage with existing monitoring activities in the region and to make very productive use of stakeholder, other members of the public and educational and research entities to form partnerships in conducting monitoring and management programs. For example, the Citizen Watershed Monitoring Network in the Monterey Bay National Marine Sanctuary has used a monitoring protocol developed by the U.S. Environmental Protection Agency in collecting information on water quality in the sanctuary. Information from this program has helped in determining where education and outreach efforts should be targeted how successful specific pollution reduction activities have been, and in identifying problem areas for further investigation.

Section 6. Financing

Achieving the goals and objectives of individual MPAs, the statewide system of MPAs, and of the MLPA itself will depend upon sufficient short and long-term funding for carrying out key management activities, including public education, research, monitoring and evaluation, and enforcement. At FGC Section 2856(a)2(K), the MLPA requires that the master plan include "[R]ecommendations for funding sources to ensure all MPA management activities are carried out and the Marine Life Protection Program is implemented."[5] One of the products of the MLPA Initiative will be the development of a comprehensive funding strategy by December 2005, which will address these needs.

For many types of management activity, including monitoring, public education, and enforcement, estimates of costs will vary depending on the intensity of the activity, which may range between essential or critical levels to optimal levels. As a result, overall costs for carrying out management activities will be a range of estimates for any one year. Estimates and actual costs will also vary from year to year, particularly in the early years as initial start-up costs are absorbed. An effective management plan will map these potential costs over several years.

Although some funds for management may be raised from local fees or from the private sector profit and non-profit communities, the primary source of funding for the management of MPAs will be state government and perhaps the federal government (Salm et al. 2000). It is also possible to reduce the need for government funding through effective partnerships in carrying out management or research activities. However, such approaches as collaborative research with fishermen and other stakeholders are only now beginning in California and require a significant investment initially, and regular investment over the long term. At the Channel Islands, in Morro Bay, Fort Bragg, and elsewhere along the California coast, fishermen, research scientists, and federal and state biologists are carrying out field projects of mutual interest, including tag-and-recapture studies that provide critical information on the movement of fish and growth rates.

Other sources of funds may indirectly contribute to achieving the goals and objectives of MPAs in a region by mitigating threats to species and habitats of concern from pollution and poor water quality. For instance, the State Water Resources Control Board might designate an MPA area as an Area of Special Biological Significance. Recent legislation places a high priority on using available pollution control funds on improving water quality in such areas.

Funding the management of a statewide MPA network should also be viewed within a broader context that includes the funding of other new and continuing efforts to maintain and enhance the living marine heritage of California, including more recent legislation such as the Marine Life Management Act and other, older legislation on fisheries, coastal and marine habitat, and water quality.

[5]The MLPA itself does not define "management activities" but defers the identification of specific management activities to the Master Plan. The logical place for the identification of management activities is the development of a management plan for individual regional MPA networks, as described elsewhere.

Because available state funds fluctuate with changes in the overall economic health and priorities of California and the Nation, marine and coastal programs of all types have to constantly adjust to these changes.[6] Funding declines at certain periods do not lead to halting all management. Otherwise, such broadly accepted functions as fisheries management would cease in lean times, with ruinous consequences for coastal ecosystems, economies, and communities. Instead, with proper planning, management continues, though with potentially less effort for non-critical tasks. Management plans are an important tool for protecting MPAs and their benefits during times of limited funding. Sound management plans can help ensure that realistic cost estimates are taken into account when such features as boundaries are decided. They also can help prioritize the most vital activities at times of low financial resources, and allocate funds efficiently and effectively when more generous funding is available.

Financing an effective system of MPAs in California will depend upon this good planning as well as tapping into a diverse array of non-governmental and governmental funding sources. A detailed approach to doing so awaits adoption of a long-term funding strategy that is being prepared by the MLPA Initiative, as well as the development of management plans for the regional components of the MPA network.

6 Currently, the state budget includes little funding explicitly devoted to implementation of the MLPA. See Endnote 5.1 for a brief history of public and private funding of MLPA activities.

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